OSF/1 ANALYSIS

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MARCH 1991

PRODUCT REVIEW

MOTIF ON SUNS STEALS USERS

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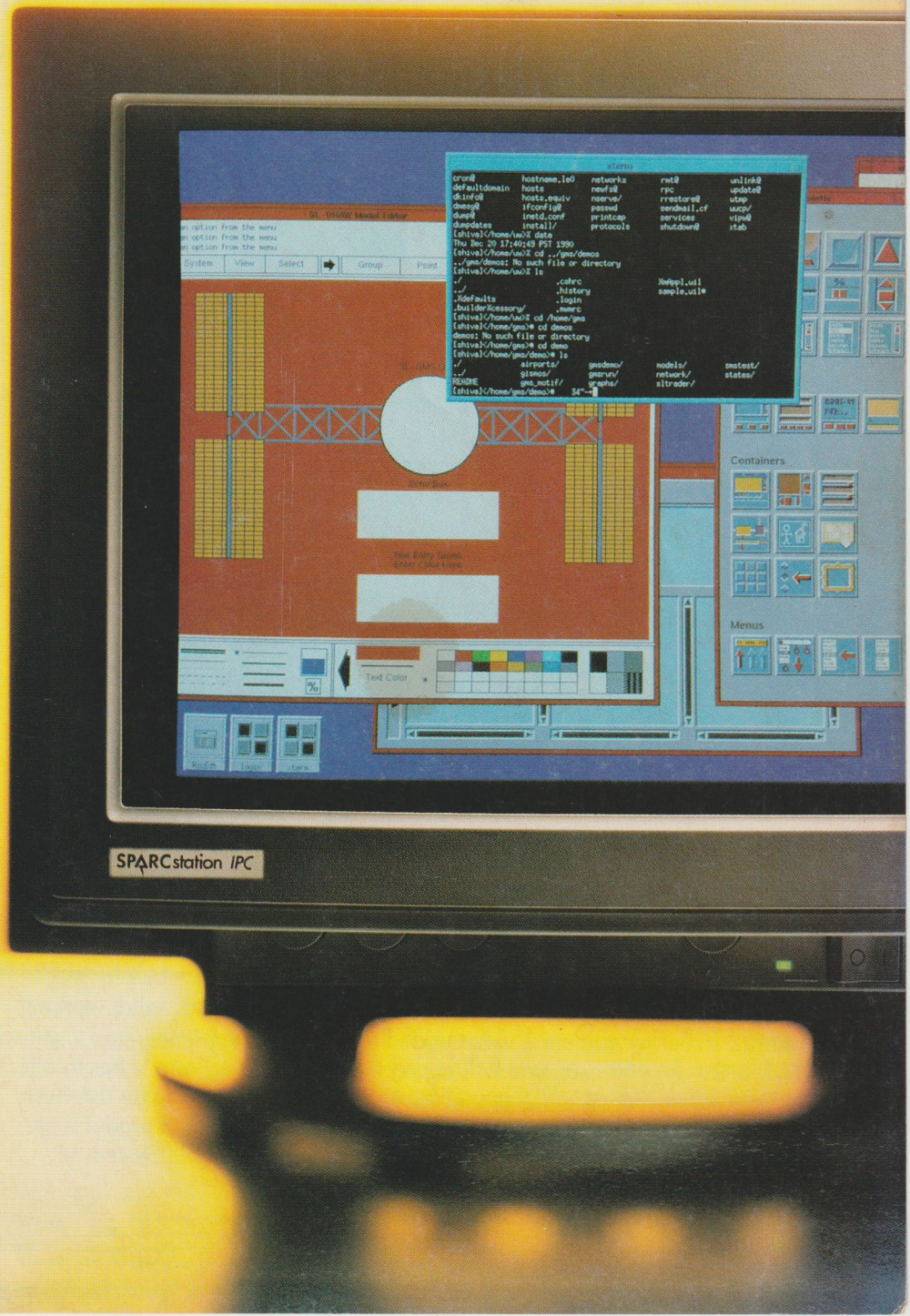
- Motif X toolkits
- Groupware put to the test

NCR under siege

C++ class relationships



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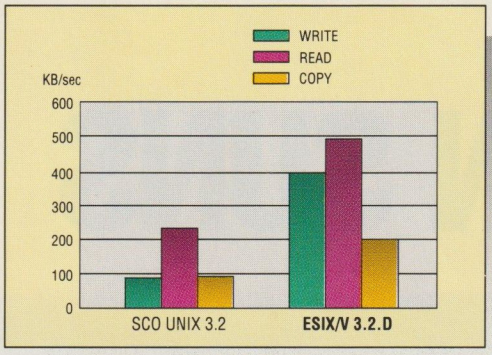

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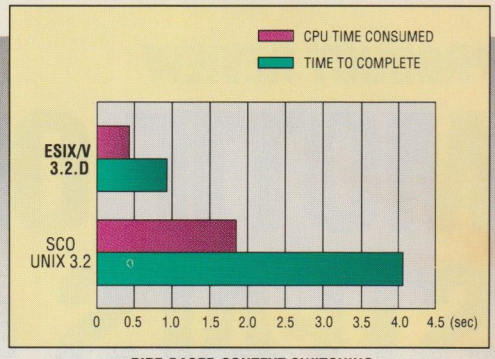

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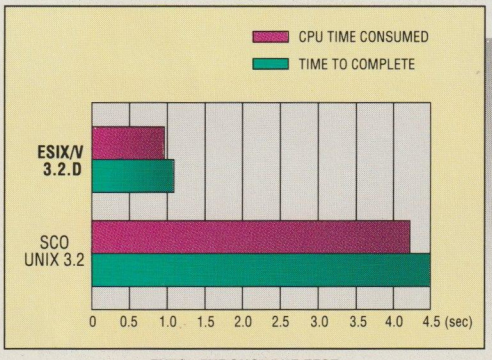

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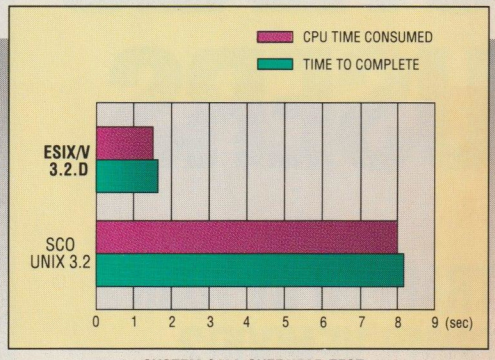

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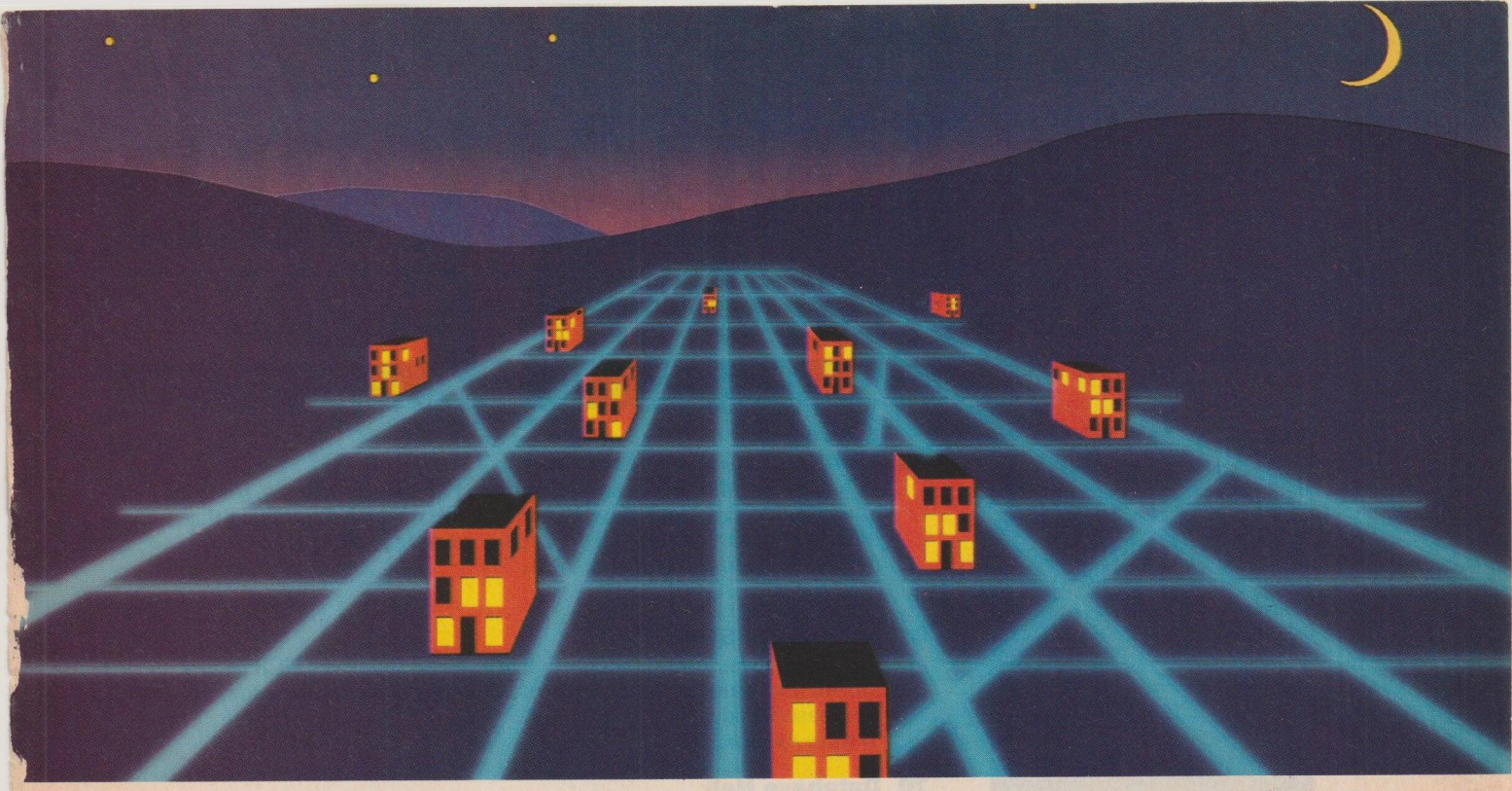

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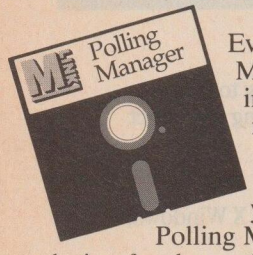

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Despite Sun's objections, the Motif graphical user interface now runs on Sun Microsystems' workstations. Several vendors are porting Motif to Suns, despite Sun's push to standardize Open Look by sheer market volume. See page 52 for a look at four Motif products and the issues involved in porting. (Cover photograph by Robert Cardin.)

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Gradient Technology's SCSI-based data acquisition device leads this month's product introductions

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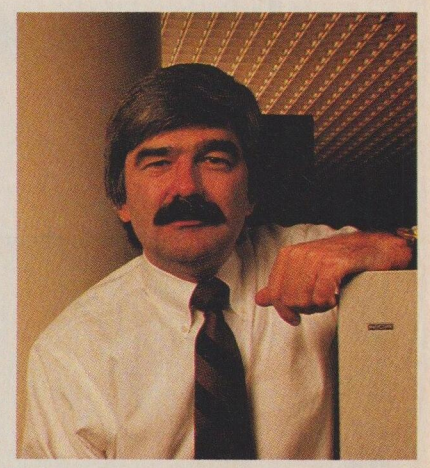
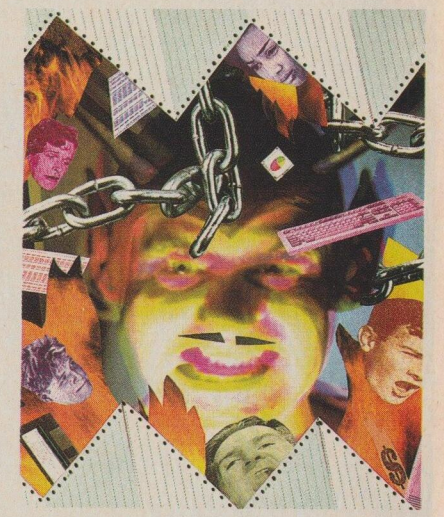


Top: *Both NCR and Tom Mays, senior vice president, lean on the success of NCR's new System 3000 line. Read about NCR's new product strategies and its efforts to remain independent of AT&T on page 61.* **Bottom:** *Making the change from one database to another can be hellish, but it is possible. For guidelines to avoid being locked into one vendor's product, see page 70.*



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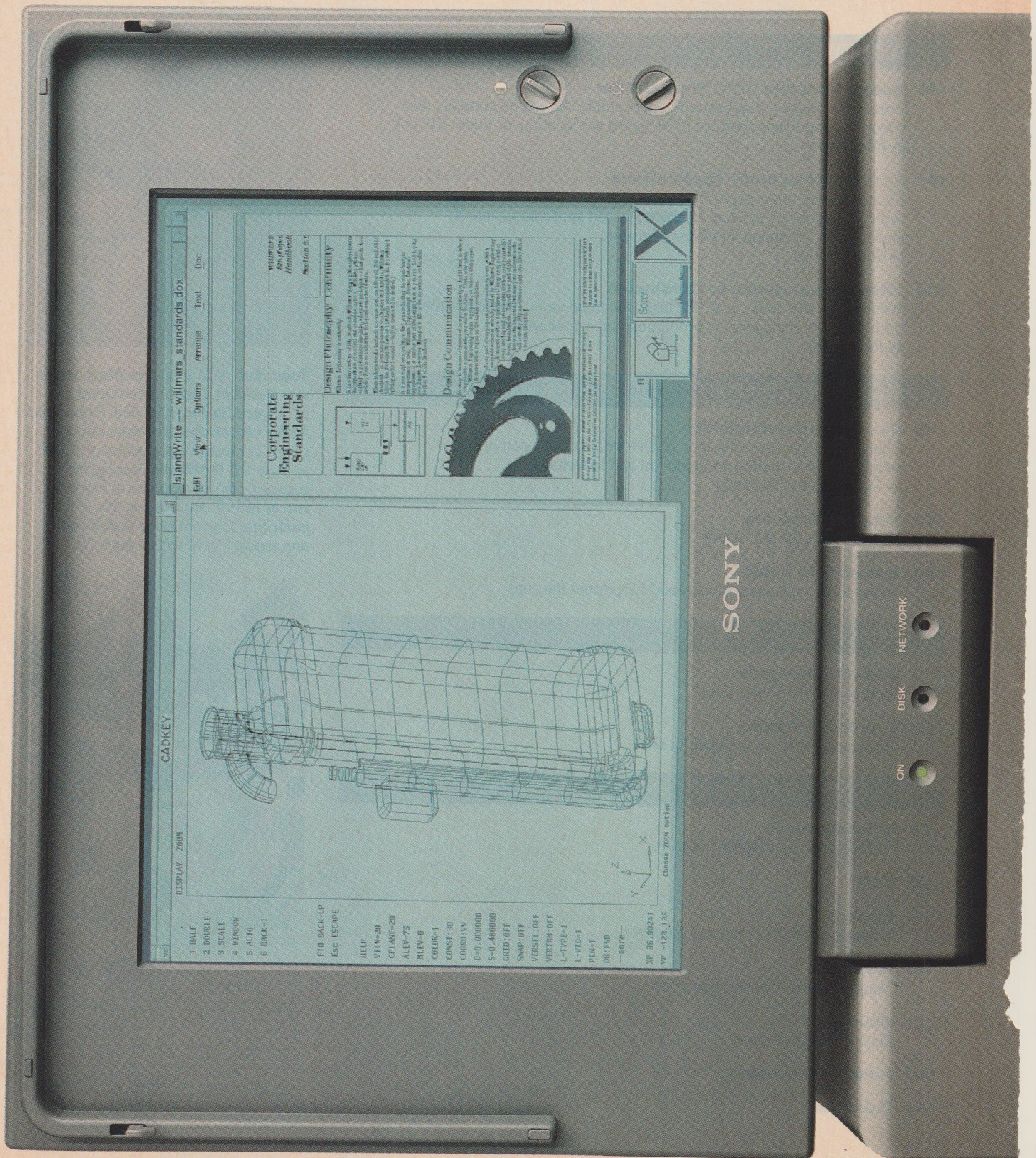

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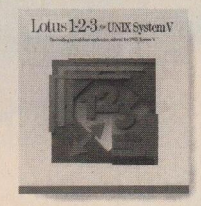

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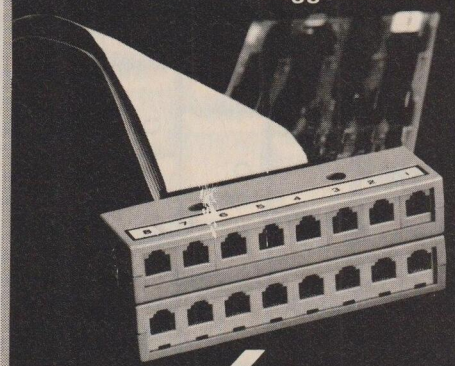

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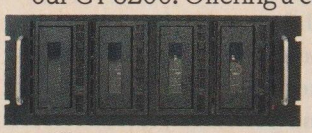

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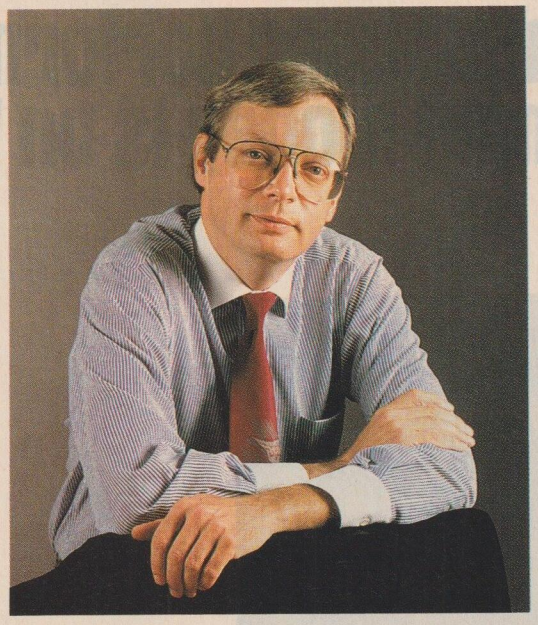


WERE YOU MISLED ABOUT LAT?

Last month, network protocol vendor Ki Research took us to task in a full-page ad. It accused us of misleading readers about a proprietary Digital Equipment Corp. protocol called LAT, which supports character terminals on Ethernet networks. Although our story never addressed whether TCP/IP or LAT better served the needs of character terminal users, the people at Ki Research were obviously upset.

We were concerned about the story ("Linking Terminals on Ethernet," December 1990) and whether Ki Research's charges were accurate. What I found in my research was more than a difference of opinion about protocols and their suitabilities for a particular use. I discovered how easy it can be to rely on beliefs and assumptions, and how difficult it can be to get an objective picture of competing technologies.

In calling around to terminal server vendors and network consultants, several facts about the LAT protocol emerged. LAT was indeed designed to provide a superior protocol for Ethernet networks. TCP/IP's Telnet requires three packets to be sent over the network for each keystroke. This means a lot of network overhead is required for Telnet that is not necessary for LAT.

I could find no one who disagreed with the points Ki Research made about the superiority of LAT over TCP/IP in their advertisement. But one technical downside to LAT emerged that did not appear in Ki Research's promotion of the protocol.

Unlike TCP/IP, LAT does not have a network layer. The purpose of the network or routing layer is to allow data to move between LANs to create internetworks or wide-area networks (WANs). This, I was told, prevents LAT data from being routed between LANs. According to critics, this is a serious drawback.

My next call was to Jim Corrigan, Ki Research's president. We spent nearly two hours discussing the article, his advertisement, and the reasons he felt compelled to run it.

Corrigan explained how he had reverse-engineered LAT and ported it to about 20 UNIX systems. He then presented this fact to DEC. Seeing its proprietary advantage lost, DEC agreed to license LAT to Ki Research on a one-time basis. Today Ki Research offers ports to more than 40 UNIX systems and Corrigan says the company has sold around 4,000 copies at between $10 and $65 per host.

Corrigan saw the issue of not being able to use LAT to internetwork between TCP/IP LANs as a straw man put up by UNIX partisans. In his view, only 20 percent of LANs require wide-area internetworking, achievable in his view by using LAT to get to a TCP/IP host and then, using Telnet to move beyond the local network.

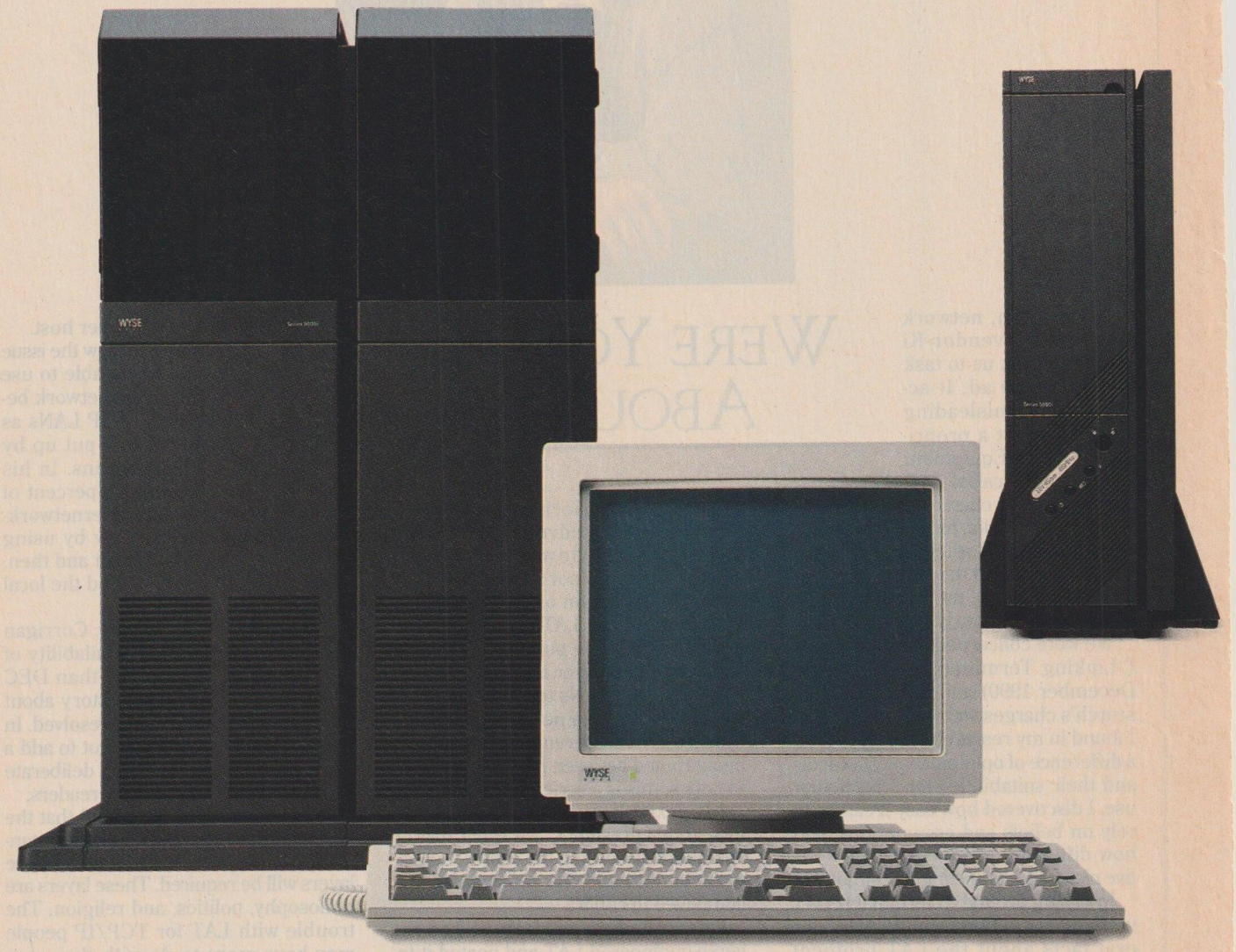
Our differences with Mr. Corrigan about not including the availability of LAT on UNIX hosts other than DEC Ultrix in a product-specific story about terminal servers will not be resolved. In our view, it was our option not to add a reference. It was not an act, deliberate or otherwise, to mislead our readers.

There's a joke going around that the current seven-layer OSI network standard is inadequate and that three more layers will be required. These layers are philosophy, politics, and religion. The trouble with LAT for TCP/IP people may have more to do with these top three layers than the original seven.

LAT comes with DEC VMS, just as TCP/IP comes with UNIX. It is an additional cost item on UNIX, but the bottom line is that it may be worth the cost. We didn't say so in our article, but we are saying it now. If you have thoughts about the value or drawbacks to LAT, I'd like to hear about them. ■

Dave Stack

In the UNIX multiuser performance race, the smart money is on Wyse.



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SUN STILL RULES WORKSTATION MARKET

Sun Microsystems remained 1990's "uncontested number one" workstation vendor with a 29.1% share of the market, according to market research firm Dataquest. Hewlett-Packard faced a disappointing 1.5% drop from 24.2% to 22.7% in its market share because it lacked a low-end RISC product line and was unable to ship Motorola 68040-based workstations. Dataquest predicts these problems will be solved by the second quarter of 1991.

A soft U.S. economy, the transition from proprietary product lines to open systems, and the maturing of traditional technical markets forced the $7.4 billion worldwide workstation market into a slowdown in 1990, according to Dataquest. The workstation market saw 21.5% growth in 1990, down from 40.3% growth in 1989.

Digital Equipment Corp. also faced a loss of market share because of ramp up problems with DECstation production. DEC dropped from 21% in 1989 to 17.7% in 1990. Intergraph ranked fourth, with Silicon Graphics coming in fifth place according to Dataquest.

As more general productivity and business applications become available and product transitions are resolved, the workstation market growth is expected to again accelerate in 1992-1993, says Dataquest analyst Laura Segervall.

ORACLE IS BACK FOR NOW

Oracle had a profitable second quarter ending Nov. 30, 1990, with $6.7 million in net income, but lingering doubts about the company's financial stability could haunt it in 1991. The Redwood City, Calif.-based database vendor reported its revenues for the second quarter of fiscal 1991 were $269 million, up 29% from the $209 million in the same period last year.

Oracle's UNIX business continued its solid climb with fiscal 1991 second quarter UNIX revenues of $87 million. Second quarter UNIX revenues for 1990 were $58 million.

Last quarter, Oracle stunned Wall Street with a $36 million loss caused by a fumbled restructuring and disastrous accounting practices.

This profitable second quarter results from the restructuring programs and tightened financial controls, say company officials. However, many analysts are pessimistic about company growth in a soft economy and they foresee an upcoming slowdown in Oracle's growth.

Bruce Lupatkin, an analyst with Hambrecht & Quist, predicts Oracle will experience yet more management "gyrations," but he says Oracle has "too large of an installed base to go down the tubes."

Other analysts warn that Oracle might face more trouble in the future as it puts more money into service and support areas, drawing money away from its R&D funding. This could cause Oracle to become a company without growth potential because of a lack of new products, say some.

MIPS SHOWS NEXT GENERATION OF RISC

MIPS Computer informally unveiled the R4000 architecture with a presentation at the International Solid-State Circuit Conference in San Francisco in February. The new architecture can run software written for the existing R3000, and is critical for MIPS to

stay in the race for high-volume UNIX CPUs against SPARC and the Intel 386/486.

MIPS says the key features of the new architecture are higher integration, scalability to 64-bit addressing, and better performance. The higher integration comes in the form of a single-chip design. Unlike current RISC CPUs, such as the R3000 and SPARC, which spread the integer and floating-point calculating units and cache controller over multiple chips, the R4000 includes all the parts on a single chip.

The R4000 design includes an on-chip 8K instruction cache and 8K data cache, as well as an on-chip controller for an external secondary cache that can be between 128K and 4 megabytes.

The company says the new CPU will also support up to 64 gigabytes of physical memory, with 2 gigabytes available for each user. MIPS says the architecture is designed to ramp up to 64-bit unsegmented addresses from the current 32-bit architectures. Company spokesperson John Mashey says memory requirements for high-end applications have been doubling every year, so that "by 1993 or 1994 you'd better be able to address more than 32 bits" for memory-intensive applications such as large in-memory databases and object-oriented programming.

In addition, the company says the R4000 will effectively double the R3000's performance with a "2-issue superpipeline," a fine-grained instruction pipeline that will complete two instructions per clock cycle (compared to one instruction per clock for the R3000).

MIPS emphasized that the architecture description was not a product announcement. However, the company clearly hopes that the chipmakers who license its designs–including LSI Logic, NEC, and Siemens, and Sony–will begin to provide R4000 chips by the end of the year.

SYBASE GROWS AT 75%

Privately-held Sybase Inc.'s revenues grew 75% in 1990, according to figures released by the relational database company at its recent 1991 User Meeting and Training Conference. Sybase's 1990 revenues ending December 31 were $100 million, up from $57 million the previous year. UNIX products and services generated 50% of the revenue in 1990. In 1991, Sybase is projecting the UNIX share will grow to 60%.

Company executives project an annual percent revenue increase in upcoming years, but Sybase officials say out-of-control growth similar what caused Oracle's problems in 1990 won't happen at Sybase.

"We've adhered to accounting rules and have a decentralized management team," says Mark Hoffman, president of Sybase. The company's rapid growth has caused some analysts to speculate about Sybase going public, but Hoffman refused to comment.

Sybase has also announced the binary standards it plans to support: X86 for DOS and Windows, OS/2, UNIX System V.3, SVR4; SPARC–BSD UNIX moving to SVR4; 88 Open–UNIX System V.3 moving to SVR4; and MIPS–UNIX 1, UNIX 2.

PYRAMID POWER

AT&T's hostile takeover bid of NCR could have a rippling effect at Pyramid Technology. Pyramid, a closely aligned OEM of AT&T, could suffer significant fall-out if NCR takes over AT&T's computer business because Pyramid has products that overlap NCR's. NCR could eliminate Pyramid's products from any future AT&T-NCR strategy.

The takeover couldn't come at a worse time for Pyramid, a company with plans to introduce a new generation of systems based on the MIPS Computer Systems Inc. processor.

A spokesperson at Pyramid says that two-thirds of Pyramid's business goes to selling machines for internal use at AT&T. "We've had assurances from AT&T's top executives that business won't be affected."

continued

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CIRCLE NO. 58 ON INQUIRY CARD

LOOKING ON THE BRIGHT SIDE

Rick Schrameck, president of RDI Computer Corp., sits in the catbird seat with a Chesire cat-like grin on his face while suitors like Sun Microsystems try to buy his 18-month old company (he has turned these offers down). And, Apple Computer Inc. might sue his company.

So why is this man smiling? It's because he has 22,000 orders for RDI's BriteLite, a portable computer that is the first machine to emulate Macintosh software without using Apple Computer's proprietary codes. (At press time the machine was scheduled for shipment in February.)

The $10,000 to $12,000 BriteLite, manufactured by the Korean computer maker Trigem, is one of the first portables based on the SPARC processor. Schrameck says it will run on SunOS, MS-DOS, and Macintosh operating systems. Apple isn't pleased about BriteLite's Macintosh emulation capabilities, but Schrameck doesn't seem bothered.

"Apple can do whatever they want, it's no concern to me," he says referring to rumors that Apple might wage a lawsuit against his company soon. "We're not selling Apple clones."

DEC AND MANNESMANN AG UNITE

Digitial Equipment Corp. has invested $233 million to form a new company with the computer division of Mannesman AG, a German company. DEC hopes the investment will provide UNIX workstation software for small- and medium-sized businesses and is in the process of porting the software to its workstations. DEC will own 65% of the new company.

CHIPS AND TECHNOLOGIES REVEALS PLANS FOR MORE MULTIPROCESSING CHIPSETS

Amid announcements of support for its PC-specific multiprocessing architecture extension (MPAX), Chips and Technologies announced it will develop multiprocessing chipsets for processors from Intel, Motorola, and MIPS. According to Advanced Products Marketing Manager Michael Ares, the target processors include Intel's still-unannounced N11, its RISC-based i860, Motorola's 68040, and the MIPS R4000.

C&T's MPAX architecture gives hardware vendors the blueprints for creating a PC-based multiprocessing system. The announcements of MPAX support came from both hardware and software vendors. SCO MPX, the multiprocessing operating system jointly produced by The Santa Cruz Operation and Corollary, will run on MPAX-based systems starting this spring. Plans are also underway for the chipset to run under OSF/Motif. On the hardware side, AMI will produce motherboards and firmware with support for up to six 486 processors, while Arche Technologies will use the chipset in its multiprocessing systems planned for release this year.

There's good news and bad news for C&T. The good news is that its closest competitor, S3, recently pulled the plug on promoting its own multiprocessing chip architecture. The bad news, according to Michael Slater, editor of *The Microprocessor Report*, is that "in the PC market, people don't know what to do with multiprocessing machines. It's a sophisticated system, and you have to be sophisticated to sell it." The companies at that sophistication level, suggests Slater, are the Compaqs and the Hewlett-Packards, which have the ability to create their own systems and chips. "They're unlikely to use an off-the-shelf chipset."

Slater also points out that C&T has chosen to use an unconventional method of cache coherency, an important facet of multiprocessing systems. "It's an interesting scheme," Slater admits, "but it's tough to evaluate these things on paper. It has good potential." C&T's Ares replies that C&T's unique cache coherency method gives the chipset its value. While the chipset incorporates a cache controller, DMA controller,

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CIRCLE NO. 213 ON INQUIRY CARD

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- The UHC system [is] quite stable . . . I did not encounter any kernel panics or serious problems.
- Installation is reasonably straightforward . . . Once installed, it ran cleanly.
- If I were using [generic 386/486] hardware, I would choose UHC.

— Jason Levitt, **UNIX Today!**, Dec. 10, 1990

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- My overall evaluation of UNIX System V Release 4.0 from UHC is very good.
- UHC's Technical Support Group [provided] quick, friendly and reliable technical help.

— Tim Conner, **The Opensystem** (newsleter of the Washington Area UNIX User's Group), December 1990.

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CIRCLE NO. 59 ON INQUIRY CARD

and system control unit, it's designed to be processor independent. As a result, to get compatibility with other processors, such as the R4000, only the cache controller needs to be modified.

ANOTHER NEW WORLD ORDER?

In what may be the first instance of a workstation manufacturer porting its CASE tools to a competing platform, Hewlett-Packard is introducing its SoftBench CASE integration framework on Sun Microsystems' SPARCstation. Product Marketing Manager Dennis Vetter says HP made the move because over half (52%) of all CASE development is being done in mixed-workstation environments.

"HP is becoming more unorthodox," he admits, because of competitive pressures and market trends. "Eleven years ago, we didn't have any competition. Now we're working with other companies via licensing [in] relationships that 11 years ago, you would have scoffed at."

Could HP be hoping that if more people are willing to buy its software, more hardware sales will be generated? Vetter insists "That's not the intent. It's not being used as a Trojan horse. We're into software and our customers demand that software runs on investments in hardware they've already made."

APPLE: X LEAPS, A/UX LAGS

Apple Computer may be half a decade behind in its UNIX support, but at least it's keeping up with the Xs. In January, the company rolled out an upgrade of MacX, its Macintosh-style X terminal emulator that complies with the X Window System, Release 4. As before, MacX provides X Windows support for both UNIX and Macintosh programs, and X11.4 compliance keeps Apple in step with other X vendors.

But Apple still trails the pack when it comes to UNIX itself. A/UX, the company's Macintosh UNIX implementation, is based on AT&T's System V Release 2, which first appeared in 1984. By contrast, many UNIX vendors are currently working to get a System V Release 4 implementation out the door. Apple asserts that much of the functionality of System V Release 4 is in A/UX. A significant upgrade of A/UX isn't expected any time this year.

Why no up-to-date UNIX? Apple won't comment, but the Mac UNIX appears to be less a multiuser operating system than a check-off item for U.S. government purchases. System V Release 2 is the earliest version of UNIX that can comply with Posix, the international standard that's now a requirement for many federal computer contracts.

USENIX TARGETS YOUNG COMPANIES

In an effort to introduce new UNIX-related advanced computing products to the technical community, the Usenix Association is hosting an exhibits forum for young high-technology companies at its summer 1991 conference and exhibition. Usenix will provide an exhibits savings package, promotion, and publicity support.

The conference and exhibition will be held June 10-14 at the Opryland Hotel in Nashville, Tenn. For more information, contact Cynthia Deno at 408-335-5646.

SUN FUNDS NON-PROFIT FOUNDATION

Sun Microsystems has announced that it has created a new charitable organization. The Sun Microsystems Foundation made its first community development grants in December to organizations in the San Francisco and Boston areas.

The company says that the quarterly grants will go to programs in education, job training, leadership, and business enterprise in locations where Sun has large operations.

continued

The foundation replaces a program of grants made through Sun's corporate affairs department.

Most of the first round of foundation grants, $189,290 worth, went to projects aimed at elementary and high school students. However, they also included programs for the homeless and ex-offenders, as well as a grant for training emigrant Soviet engineers in computers and English.

THE FLY ON THE WALL

The Fly–*UNIXWORLD*'s gadfly–made a stop in New Jersey where UNIX System Laboratories (USL) *officially* began talks with vendors regarding buying percentages of the company. But sources say that negotiations started in late 1990 with a lot of Japanese interest. Three Japanese companies–Fujitsu, NEC, and Toshiba–are reportedly buying a stake in USL. Another 10 companies are negotiating for 40% of USL.

The Fly then buzzed over to the offices of Next Computer Inc. in Silicon Valley, where some sources say that Next continues to have monumental sales problems. That includes potential multi-million contracts lost because of Next's reluctance to allow customers to test Next's products.

On to lunch one day at Lynx Real-Time Systems, where the Fly listened in on a job interview with a vp-level salesperson from another real-time UNIX company. It seems one of Lynx's direct competitors is leaking cash, and is soon to be leaking employees.

Later, the Fly received a call from his cousin in Dallas who visited the Unisys offices there. Unisys has enacted new reporting relationships in its U.S. sales and marketing organization aimed at giving more authority and autonomy to each organization, but Unisys employees in Dallas (and presumably in other offices) seem confused.

The Unisys restructuring has eliminated all third-party managerial positions. These managers are going back into direct sales, but the restructuring has caused so much confusion that third-party marketing people aren't sure who they're supposed to report to. Morale is extremely low and the sales offices are starting to look like "ghost towns" as positions are eliminated or people leave, says one source inside the company.

And finally, the Fly took a ride in a fruit-filled semi-truck to Redmond, Washington, where Microsoft is reportedly working on Microsoft compilers (for various languages, not just C) for Sun and HP workstations, and hopes to have them available by June.

OVERHEARD

The 27th Amendment to the Constitution of the United States, as suggested by Doug McLean, Apple Computer product line manager of network integration:

"No knowledge worker shall have his or her inalienable right to use whatever desktop device he or she desires abridged by any power, foreign or domestic."

The 28th Amendment to the Constitution, as envisioned by McLean, which will be put forth by the network managers of America six months later:

"No knowledge worker shall be entitled to connect their desktop device to the corporate network unless said device qualifies for network citizenship according to the regulations specified by the network's management."

At Macworld the Boeing Computer Services representative announced that, due to the aircraft manufacturer's commitment to OSI, it will no longer use Appletalk. In response, McLean said, "This gives me the chance to announce the new Apple travel policy. We will only fly L-1011s and Airbuses." ■

—Edited by Gary Andrew Poole with staff reports. Please send any breaking news or comments to him at: `uunet!uworld!garyp`. *Or call him at 415-940-1500.*

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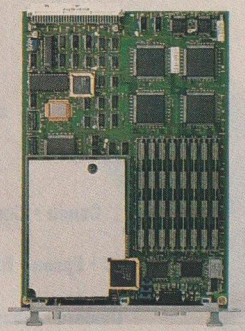
CIRCLE NO. 241 ON INQUIRY CARD

Can you spot the difference between these full-motion video systems?



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CIRCLE NO. 208 ON INQUIRY CARD

PLEASE, NO SLICKNESS

Dear Editor:

My fear when McGraw-Hill took over UNIXWORLD was that the magazine would become yet another slick computer publication. What I liked most about UNIXWORLD was its commitment to the shell and teaching shell scripts that were above the idiot level, but below the professional programmer level.

Despite the prediction in December 1990 "Editor's Thoughts" that in the late 1990s users will discover shell scripts and the simple beauty of the UNIX shell, the magazine seems slicker, and the commitment to the shell seems less. Please do not wait until the late 1990s to rediscover your roots.

David A. Hirsch
Beckman & Hirsch Law Offices
Burlington, Iowa

System Software & Tutorial Editor Dr. Rebecca Thomas replies: Although the magazine has become more business oriented, Wizard's Grabbag, Tutorials, and Answers to UNIX maintain the same mandate of providing programming tools to solve readers' problems. These tools are either shell scripts or C programs as appropriate. We're glad to hear that you find them useful and want to see more.

Surf's Up, Dudes!

Dear Editor:

Read your "Top 10 UNIX Companies" (December 1990). Cowabunga! Did anyone else notice that all five of the software vendors and two of the five hardware vendors are based in California? Not to mention your magazine and others. Maybe that is why people have a love/hate relationship with UNIX–it parallels their feelings for California. Got to go–I can see from my window that "surf's up!"

Andy Levinson
Studio City, Calif.

Oracle's Growth in UNIX

Dear Editor:

I enjoyed reading your December 1990 story on the Top 10 UNIX companies. However, this year's report on Oracle contains erroneous information resulting from mixing proverbial apples and oranges. The article notes that Oracle's UNIX revenues for 1990 were $250 million, and points out that our growth rate was merely 25 percent. This growth rate is false.

Oracle's UNIX license revenues were in fact $250 million for the fiscal year ending May 1990. But that compares to license revenues for the prior year of $120 million. Last year's report referenced Oracle's UNIX-related revenues, which include consulting, education, and support related to UNIX licenses. The figure for fiscal year 1990 is $340 million, which compares to $165 million in 1989.

Whether reporting UNIX license revenues or UNIX-related revenues, the growth rate exceeds 100 percent, rather than the 25 percent you reported. Of course, the revenues would be even larger if we were discussing our results for the 1990 calendar year. Oracle's UNIX product line continues to be the fastest growing for the company, with a compound annual growth rate of more than 120 percent for the last six years.

Stan Tims
Senior Director
UNIX Products Division
Oracle Corp.
Redwood Shores, Calif.

Wants to Reorganize the Top 10

Dear Editor:

As an opening note, I would like to compliment you on the growth of quality and professionalism of your magazine. As a UNIX vendor for the past 10 years, magazines such as yours have helped fuel the customer base for open systems and–more importantly–for UNIX. Please pass on my congratulations to your entire staff. They deserve it.

In your November 1990 issue, you identified the top five hardware and software companies respectively. I have a simple suggestion for next year.

It is obvious that hardware and software companies have significantly different businesses and are therefore treated separately to allow for a meaningful comparison. However, software companies should also be separated by system software companies and application software companies to effectively gauge the maturing of the market. Historically, computer markets have evolved from an emphasis on hardware to system software and then to application software.

My recommendation would be to portray the market by separating operating system software companies from applications system software companies. Should you not do so, it is inconceivable to not include AT&T as well as a number of other companies that derive revenue or hardware or both. As you can see, there is a need to separate the key elements for a better understanding of leadership in the industry.

Jeffrey H. Waxman
President and CEO, Uniplex
Irving, Tex.

Editor's reply: What we term hardware manufacturers typically include hardware, system software, application software, and even support in their revenues. Perhaps our category should be termed systems rather than hardware. However, system software companies, such as The Santa Cruz Operation, also sell applications, complicating the consistency you desire. There are so few companies that sell the UNIX operating system without also selling hardware or application software that we don't see the need for an extra category.

Yet More on awk

Dear Editor:

This is another comment on the December 1990 review of IBM's RS/6000.

One aspect that was not noticed–and IBM does not advertise it widely–is that the RS/6000 has no single-precision arithmetic. Normally this is not a disadvantage, as the extra precision does no harm. Single precision is provided in software for compatibility with other 32-bit boxes and presumably involves converting the operands to double precision, and the result back to single precision. As a result, according to my tests, single-precision arithmetic runs about three times slower than double precision.

continued

I presume that **awk** uses single precision. This may be the source of the discrepancy between your benchmark and other users' (including ours) excellent results. Realistically, even the 320 model should perform at least five times better on floating-point tests than a 486 machine.

Using **awk** to measure floating-point performance is like evaluating a Porsche through testing its ability to tow a U-Haul trailer.

Peter Pulay
Distinguished Professor of Chemistry
University of Arkansas
Fayetteville, Ark.

Let's Get Real About Altos

Dear Editor:

My office has used Altos devices for over six years and I have been pleased with the Altos company products and service through a local Tulsa dealer.

In the December 1990 issue, I read the article "PC Giant Buys Mini Troubles." My understanding was that Altos may not survive, especially because of VAR relationships. I called the local dealer about the article and he was astonished. He immediately brought over *Varbusiness*' 1990 Annual Report Card Review, which reports that Altos is near the top–if not the leader–in VAR relationships.

So what is the reality? The author Gary Andrew Poole is critical while a competing journal is not. What's a user to believe?

Gerald E. Gustafson, M.D.
President, Surgical Associates Inc.
Tulsa, Okla.

Features writer Gary Andrew Poole replies: Analysts, company representatives, and former employees of Altos interviewed for the story all said Altos has had problems keeping its VAR channels satisfied. Even President Ron Conway acknowledged this. While he has unveiled new strategies to strengthen VAR relations, the analysts I talked with said a dearth of new product introductions has caused new apprehension among VARs.

Act of Terrorism?

Dear Editor:

As a Turk and an American citizen, I am deeply offended by the title "Like a Midnight Express" that you used for the "Industry News" column in the November 1990 issue.

How dare you insult Turkish people by calling the news "Like a Midnight Express"? The movie called "Midnight Express" expressly insulted Turks. It was made by Armenians in substantiating their hate against the Turkish people. Armenian terrorists have assassinated more than 50 Turkish diplomats in recent years. You are supporting terrorism by your selection of the news title. Surely you can select a more descriptive title for the growth of the computer market in Turkey. Your selection is racist

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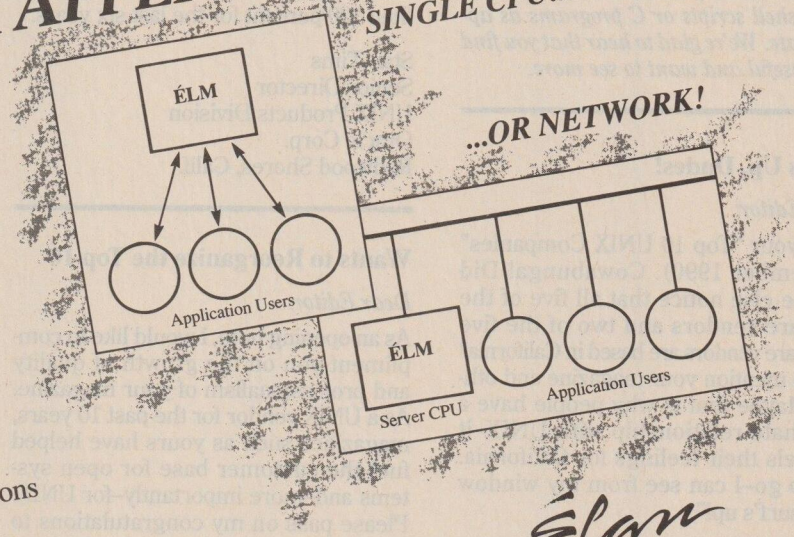

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Osman Balci, Ph.D.
Associate Professor
Virginia Polytechnic Institute
and State University
Blacksburg, Va.

Praise for Ice.Ten.Plus's Versatility

Dear Editor:

I was extremely pleased to see the Ice.Ten.Plus emulator from the James River Group reviewed in your November 1990 issue. Your review said there was no multisession feature. Our company accomplishes this through an I/O board from Computone called the IntelliPort. With this combination, any of our users running PCs as terminals can have three tasks running at any time: one on the MS-DOS side and two on the XENIX side.

A feature you failed to recognize was the ability to have more than one copy of Deja Vu on the same system. The first copy would be set up with the parameters to emulate a terminal on the local XENIX system through COM1, while the second copy could be set to emulate a terminal on a remote system through COM2. A separate set of "hotkeys" would invoke either of the two versions of Deja Vu. I have even configured Deja Vu to emulate terminals on operating systems other than UNIX/XENIX.

Also, the UCOPY feature cannot be praised enough. Its ability to recognize either the forward or backward slash should not go unnoticed. Your article talks mostly about DOS-to-UNIX transfers, but UCOPY works just as well as a UNIX-to-DOS channel. A file created on UNIX/XENIX can be transported to DOS for work at home and then back to UNIX the next morning.

The one shortfall we have found with Ice.Ten.Plus is an incompatibility with the Compaq 286 BIOS. If the num-lock key is on none of the arrow keys, page up, or page down, then it will work. If the num-lock is off both sets of arrow keys, then it will work. I have tried different keyboards, but have not solved the problem.

Lee Peedin
Data Processing Manager
Earth Property Services, Inc.
Wallace, N.C.

Hypertext for Private Use

Dear Editor:

I was pleased to see Alan Winston's November 1990 article, "The Age of Hypertext." It gives a nice overview of the various types of hypertext systems under development, and shows that there is much more to the field than just Apple Computer's HyperCard.

One area he did not mention is the application of hypertext techniques to the task of organizing one's private data. A hypertext notebook, with each page a "node" and cross-references as "links," works well for this purpose. Rather than allowing access to information pre-

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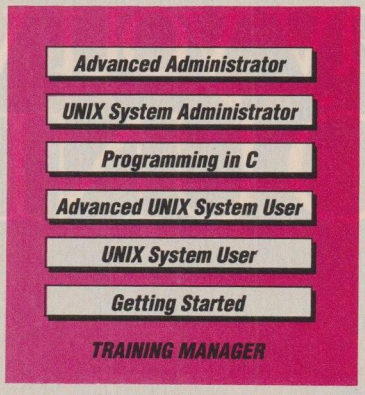

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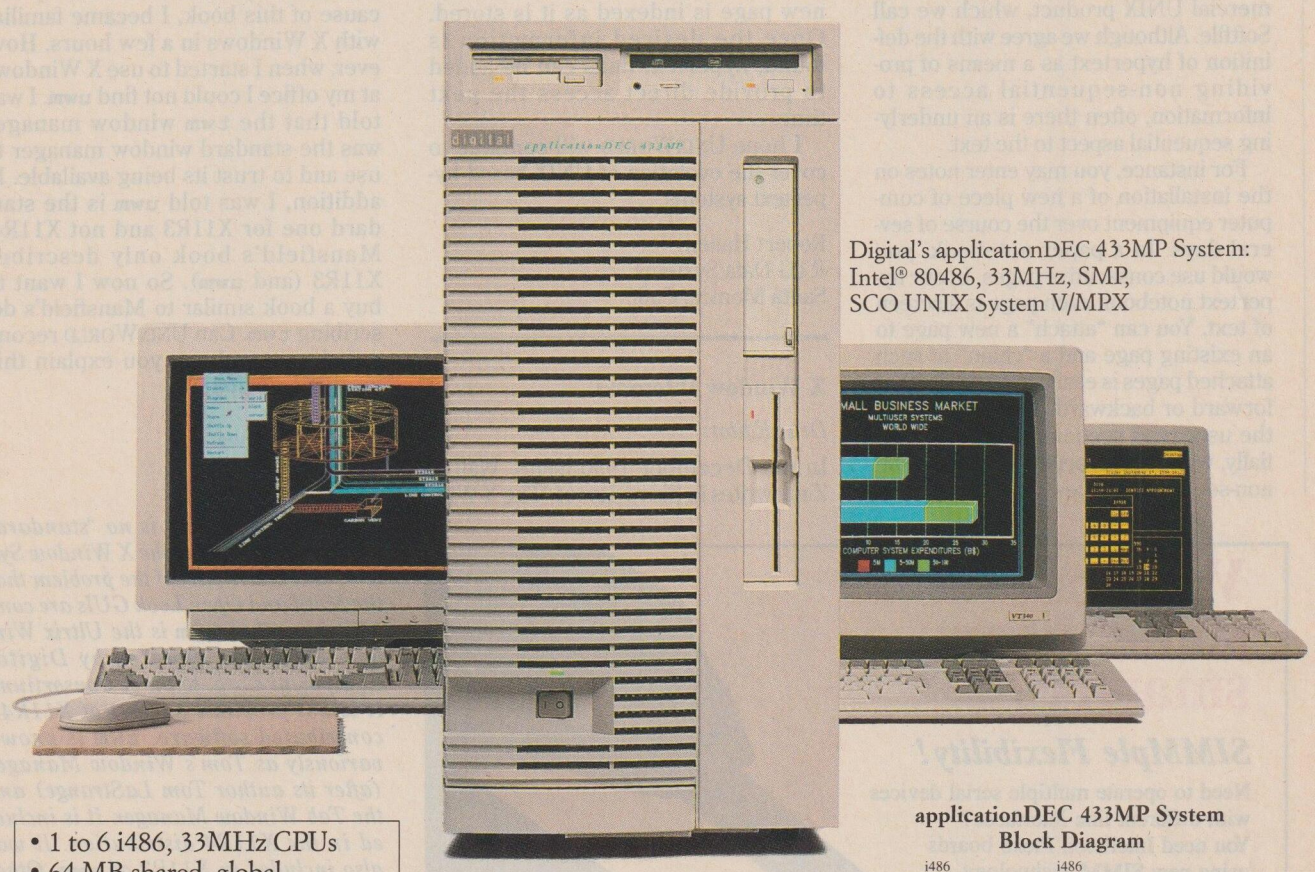

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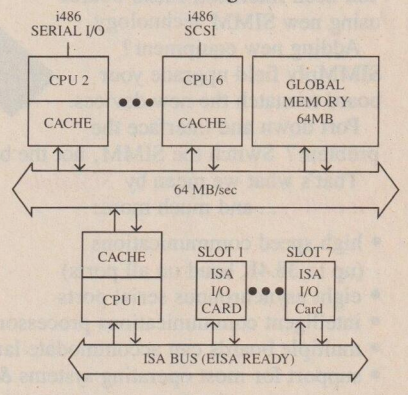

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pared by someone else, a hypertext notebook allows an individual user to create "personal" hypertext. A page might contain notes of a telephone conversation with links to previous conversations and to background information on the caller.

We developed this idea into a commercial UNIX product, which we call Softfile. Although we agree with the definition of hypertext as a means of providing non-sequential access to information, often there is an underlying sequential aspect to the text.

For instance, you may enter notes on the installation of a new piece of computer equipment over the course of several days. In a paper notebook, you would use consecutive pages. In our hypertext notebook each page is a screen of text. You can "attach" a new page to an existing page and a "chain" of such attached pages is easily traversed either forward or backward. This feature lets the user read sections of text sequentially, while the hypertext links provide non-sequential access.

Another problem arises in creating your own hypertext, because you must also be the "expert" who creates the links between pages. To ease this difficulty we let the user search for words in the text in the manner of a full-text retrieval system. However, unlike most full-text systems, each new page is indexed as it is stored. Once the desired information is found, hypertext links can be added to provide direct access the next time.

I hope UNIXWORLD will continue to cover the evolution of UNIX-based hypertext systems.

Robert Hallem
RTG Data Systems
Santa Monica, Calif.

X Window Dilemma

Dear Editor:

In the December 1990 issue, Walter Zintz writes in his review of "The X Window System: A User's Guide" by Nial Mansfield, that `uwm` is the only window manager in the official release of X Windows, and this book is restricted to this version.

When I was first exposed to X Windows, I read Mansfield's book which I found exceptional in its clarity. Because of this book, I became familiar with X Windows in a few hours. However, when I started to use X Windows at my office I could not find `uwm`. I was told that the `twm` window manager was the standard window manager to use and to trust its being available. In addition, I was told `uwm` is the standard one for X11R3 and not X11R4. Mansfield's book only describes X11R3 (and `uwm`). So now I want to buy a book similar to Mansfield's describing `twm`. Can UNIXWORLD recommend one, and can you explain this costly confusion?

Reinert Korsnes
Norway

Editor's reply: There is no "standard" window manager for the X Window System, and this is part of the problem that the Motif and Open Look GUIs are competing to solve. `uwm` *is the Ultrix Window Manager, donated by Digital Equipment Corp. to the X Consortium. It is not provided as part of X11R4's contributed software.* `twm` *is known variously as Tom's Window Manager (after its author Tom LaStrange) and the Tab Window Manager. It is included in the X11R4 distribution. It was also included in X11R3 as* `awm`*. Other useful books are "X Window System User's Guide for Version 11," from O'Reilly and Associates, and "X Window System Toolkit, The Complete Programmer's Guide and Specification," from Digital Press.*

UNIXWORLD welcomes letters to the editor because your opinion matters to us. If you would like to comment on past articles or just voice your opinion on an issue, either write to us at 444 Castro St., Mountain View, CA 94041, or send us e-mail at the following address: `uunet!uworld!letters`.

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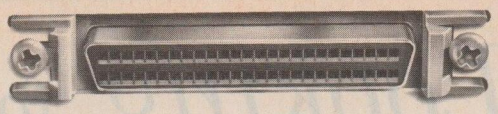

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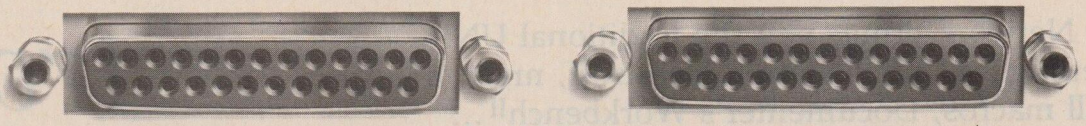

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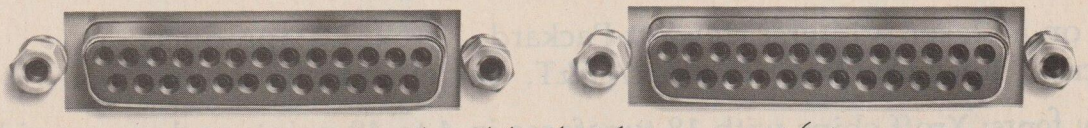

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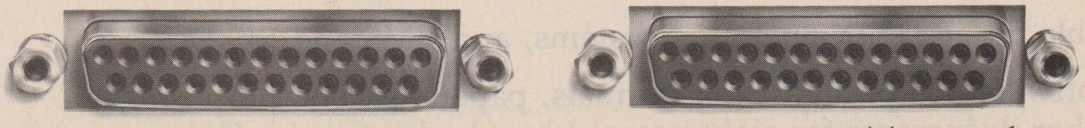

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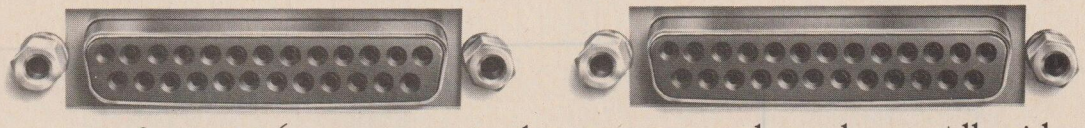

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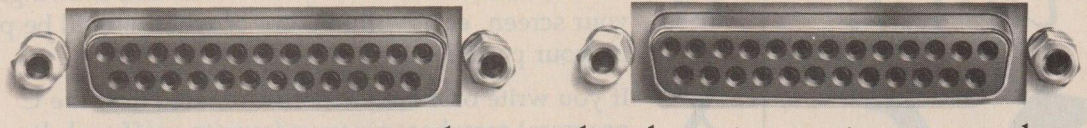

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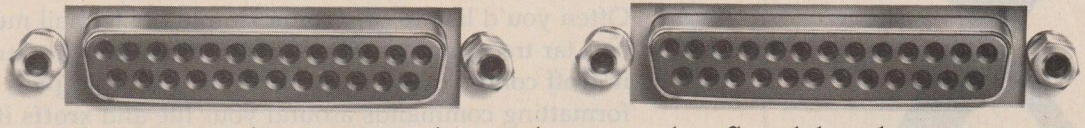

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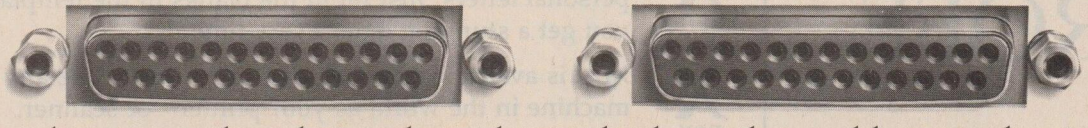

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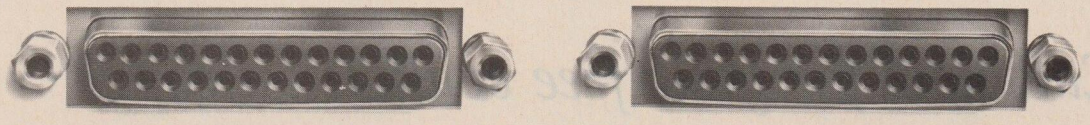

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Howard Baldwin

MUCH MORE THAN JUST THE FAX, MA'AM

If facsimile machines have taken the world by storm, UNIX-based fax solutions are not far behind. For every software developer working on an engine to run fax servers, there are dozens more application developers and systems integrators using that software to develop fax-based solutions for service bureaus, sales offices, and other support operations.

In the meantime, Perfect Byte has given application developers a head start on developing the next generation of fax-based products with its PerfectCOM communications subsystem. Its current fax-based product, the FAXmodem 9600 subsystem, incorporates both fax software and a 9600 baud modem, and attaches to the serial port of a Sun-4 workstation. The new product, the S-Bus-based PerfectCOM, combines several increasingly pervasive technologies: fax, voice mail, X Windows, and audio compression.

The communications subsystem encompasses several communications products. It incorporates a data modem, that supports the International Telegraph and Telephone Consultative Committee's (CCITT) V.32 *bis* standard, and Microcom Network Protocol (MNP) levels one through five. It supports full-duplex capabilities–that is, two lines transmitting going back and forth at the same time, at 14,400 bits per second (bps).

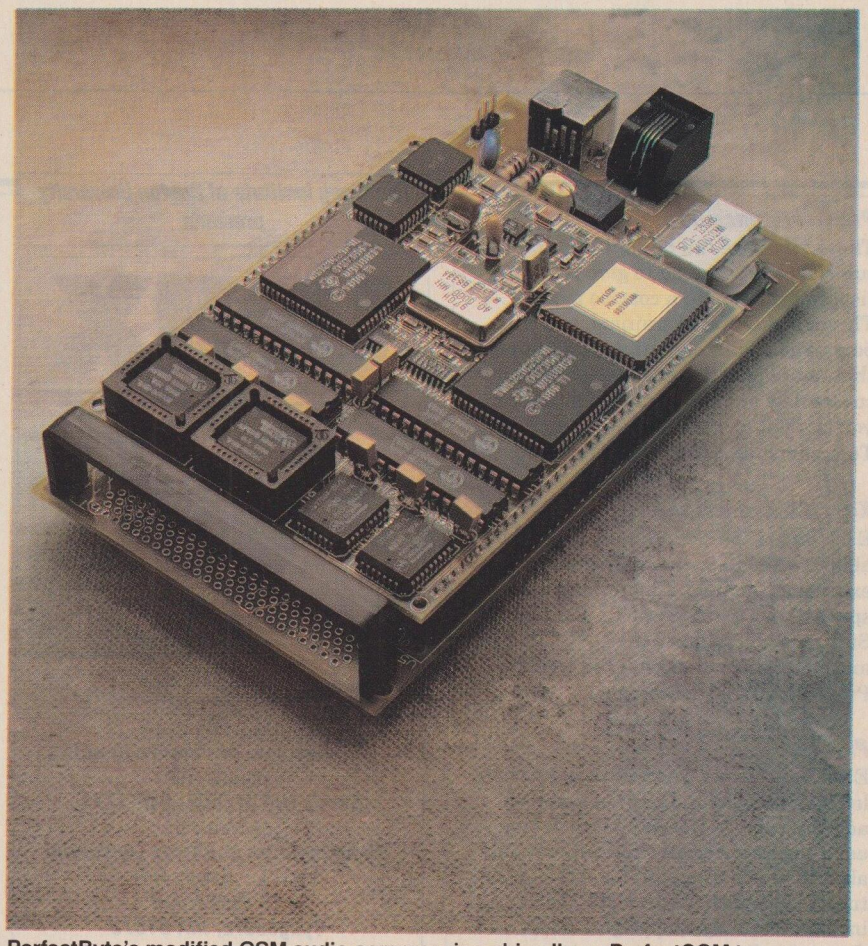
In addition to the data modem, there's also a fax modem with automatic dialing and answering capabilities. Used with the company's PerfectFAX software, which isn't included in the new PerfectCOM product, the new fax modem can generate facsimiles from PostScript files, ASCII text, electronic mail, or raster-based graphics data, and transmit them. It can also take inbound communications transmitted in the Group III standard format, which requires fewer megabytes than a standard graphics file, and save them as PostScript files, TIFF (tagged image file format) files, or other raster file formats.

Here's where it gets slick. Perfect Byte has taken something called the GSM audio compression standard (which originated in Europe for use with digital cellular telephones) and modified it for use with the board. As a result, PerfectCOM can digitize and compress audio information for input into the host workstation. Because the PerfectFAX software supports direct inward dialing (DID) for routing and delivering inbound faxes, it can be used with PerfectCOM to create a store-and-forward voice mail service for larger organizations.

The board also supports touch-tone recognition and other features for signal recognition and generation. The board features digital signal processors and downloadable random access memory instead of EPROMs (erasable programmable ROM). The RAM lets you upgrade to new communication standards without exchanging firmware.

While all this may sound like an excellent way for machines to talk to machines, the product also takes into account that humans still talk to humans.

continued



PerfectByte's modified GSM audio compression chip allows PerfectCOM to digitize and compress audio information for input into a workstation.

Because so many workstations now have audio capabilities, incorporated within PerfectCOM is audio communication via X Windows. Perfect Byte President Keith Wagner refers to it as the "hack and yak" method of communication.

The magic is done with what Wagner refers to as a "pseudo X server" running on top of the X server at both the local and remote sites. "The pseudo-server intercepts the local display of general X Windows applications, then multiplexes it with audio for transmission to a remote X pseudo-server," he says. The first implementation, he says, is a master-slave relationship, which means that the person initiating the communication has control over the window, and can manipulate data in the window while the recipient can only watch, listen, and ask questions.

Later implementations will include master-with-many-slave implementations, and then peer-to-peer multiple participation. Wagner notes that users can already do some of these things within products like Bolt, Beranak & Newman's BBN/Slate integrated office software, but only if both parties have the same applications software. PerfectCOM expands the ability to any X-Windows-based application. Wagner sees "hack and yak" being used in teleconferencing, technical support, and training programs.

For the systems integrator or application developer, PerfectCOM opens up numerous capabilities. It's not just office automation applications, or instances where employees are on the road and need to access information by telephone on a host computer, but any kind of transaction processing and on-line service to be provided by telephone. Wagner cites the financial community, where bank customers can call up and access their bank account balances via a touch-tone telephone.

Take the office automation scenario, for instance. With the development of a relatively simple menu of choices, users could call in to listen to voice mail, and then store or forward those messages. An application using PerfectCOM, incorporating the audio compression chips, could also allow users to have their electronic mail synthesized into speech and recited by the workstation.

Users could, through a touch-tone telephone, have their workstation fax their e-mail to the fax number of their hotel. He also envisions applications that would allow users to call into their system and retrieve not only information from their mailbox, but also appointments from their on-line calendar and and telephone numbers from their on-line Rolodex.

In its initial form, PerfectCOM is an S-Bus-based board for SPARCstations, priced at $2,495. Later this summer, it will be available as a standalone device that links into a workstation's serial port for $2,595. Perfect Byte is currently working on making the product compatible with workstations from Digital Equipment Corp., Hewlett-Packard, IBM, and Silicon Graphics. **Perfect Byte, Inc., 7121 Cass St., Omaha, NE 68132; 402-554-1122.** ■

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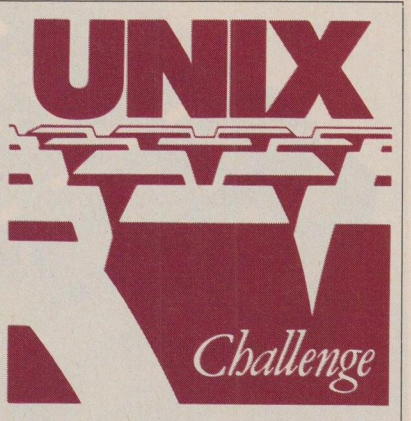

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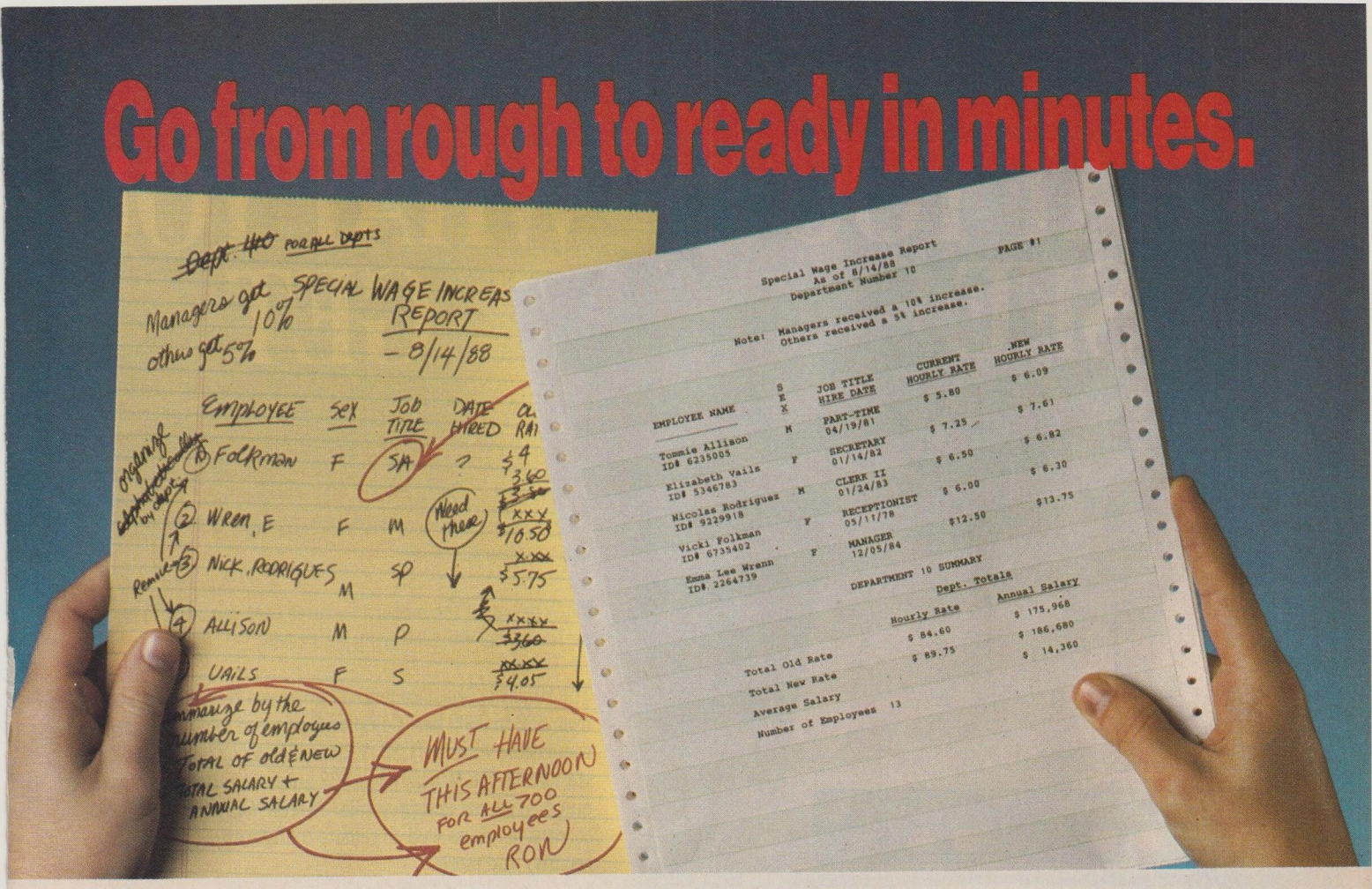

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CIRCLE NO. 171 ON INQUIRY CARD

Reviewed by Walter Zintz

BOOKS TO TAME THE COMPUTER MANAGER

Let's step back this month for a look at four books that give managerial views of several key questions in computing. The first two are for decidedly non-technical readers, while the second two will interest heavy-duty programmers.

LAN OPERATIONS: A GUIDE TO DAILY MANAGEMENT

By Peter D. Rhodes
Addison-Wesley;617-944-3700
268 pages;18 pages of Index & Contents
ISBN 0-201-56301-0 hardbound;$39.75

You get a good deal more in this book than the title promises. First, day-to-day operations are only the major subject. Several chapters delve into areas that are definitely the domain of long-range planning.

The author does not restrict himself to local area networks (LANs), computer link-ups whose geography rarely extends farther than two miles or so. Almost as much attention is given to wide area networks (WANs), which often span a continent or more, and especially to WANs created by linking LANs together.

This book aims strictly at managers, and fairly high-level managers at that. At each turn the author explains everything in terms of how it helps or hinders the organization's purposes, the ways an organization's internal politics will affect–and be affected by–decisions made, and results with regard to the financial bottom line.

Technical matters are overviewed at best. This book talks tech at the Sunday newspaper level, and not always too well even by that standard. Some of the technical descriptions are either so light, as to tell the reader almost nothing, or phrased in ways that might leave a non-technical manager in a state of misunderstanding. As an example of both faults, consider the author's attempt to explain a packet network as one where "the charge is based on bandwidth and the number of packets sent," without a word on what a packet might be. This is not the right book for a technical trainee–not even as an overview of the field before getting down to the technical underpinnings.

Within these limits the book is rather thorough. There are chapters on configuration, faults, security, usage accounting, standards, and personnel, plus three interrelated chapters on performance, measurement, and reporting. Most chapters end with a brief case history. An appendix rephrases much of this information, along with some new material, from a user's viewpoint. The book ends with a brief bibliography and a too-brief glossary, where the definition of packet is just as unhelpful as the explanation of packet networks cited above.

Review Highlights
Technical Level: Raw Beginner
Understandability: Average
Summary: LANs and WANs from the executive viewpoint.

OBJECT-ORIENTED TECHNOLOGY: A MANAGER'S GUIDE

By David A. Taylor
Servio;800-243-9369, 415-748-6200
147 pages;6 pages of Index & Contents
paperbound;$10

This is one of the best-produced books I've reviewed in this column. The pages are printed in two ink colors on a coated paper stock that's been matte-finished to avoid glare. The numerous diagrams are done quite artistically. Wide margins are filled with overviews of the topics under discussion in the main text (this is in addition to the conventional heads and subheads), and captions for all of the illustrations.

The obvious audience for this book is in the executive suite. Although the topic is software development, the author assumes no more than the most general understanding of software and programming among his readers. He discusses some extremely technical points, but always from the managerial point of view.

Only about a dozen really technical terms from object-oriented programming are used. Most are explained three times: in the text, in a glossary, and in a short "Summary of Key Concepts." The book reflects the growing consensus on common names for concepts that were previously named independently by each object-oriented programming language designer, and includes a chapter on the very new field of object-oriented databases.

Much of the nature of this book was apparently determined by the publisher's role in the field it discusses. Servio is a vendor in this field, and so the book quite rightly doesn't discuss the pros and cons of individual object-oriented programming languages or related software-development tools. Nor is it a trumpet call to join the glorious charge into object-oriented software development. The author's attitude throughout is that the technique has its liabilities as well as its benefits, and it's up to each reader to decide whether this approach is the right choice under the circumstances.

Analysis of pros and cons of object-oriented technology, the lesser part of this book, tends toward blandness. I'm on the fence about the quality of the non-technical explanations of the technicalities. On the one hand, I haven't seen a better explanation in print for this class of reader. On the other, I think we're still some distance away from putting these matters as clearly as they can be put.

Review Highlights
Technical Level: Beginner
Understandability: Average
Summary: A guide to knowing the basic concepts of object-oriented software without becoming a techie.

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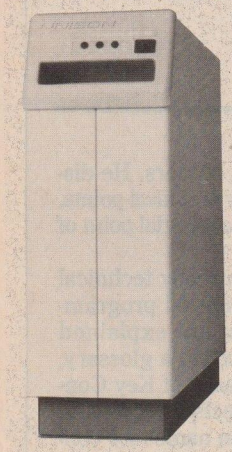

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INTRODUCTION TO THE THEORY OF PROGRAMMING LANGUAGES

By Bertrand Meyer
Prentice-Hall;201-592-2000
448 pages;17 pages of Index & Contents
ISBN 0-13-498510-9 hardbound;$50.40
ISBN 0-13-498502-8 paperbound;overseas only

This is the first book I've seen that can make many of the concepts in programming language theory accessible to working programmers. It tells a lot about how ideas are encoded in programs, and how compilers decode those programs as preparation for translating them into machine code or p-code. Better yet, it does this in a way that should make the knowledge useful in such ordinary business as picking a language for a programming project. But it's not a quick, easy read.

For starters, you'd better have some background in modern mathematics–particularly set theory. Then you should have a taste for learning new languages just to follow the text. More than half the book is written around an example programming language named GRAAL (Great Relief After Ada Lessons) and a meta-language the author calls Metanot (Meta Notation). Other example languages, such as GRUNTS (Generally Recognized by Users as Not Too Strict) and LULLABY (Little Used Lilliputian Language Appropriate for Beginners and the Young), pop up briefly.

That said, this is a straightforward, unarcane book. The author considers this volume appropriate for a semester course in the subject (even at the graduate level) and I agree. But it's also direct and practical enough to be worthwhile for people out in the field. The writing is not obscure, and the author's personality and sense of humor show through well enough to make pleasant reading for those prepared to face the technical aspects I've mentioned above.

There are a few diagrams in these pages, a modest amount of example code in the various example languages, and a lot of mathematical/logical statements expressed in Metanot. All chapters offer suggestions for further reading, and all but one end with challenging exercises. No answers to the exercises are provided, which is unfortunate in this situation because readers don't have compilers for GRAAL, GRUNTS, or LULLABY available for testing their own solutions.

Review Highlights
Technical Level: Advanced to Theorist
Understandability: More than Lucid
Summary: A lot of language principles made fairly simple for the mathematically minded.

APPLICATIONS OF OBJECT-ORIENTED PROGRAMMING

Edited by Lewis J. Pinson and Richard S. Wiener
Addison-Wesley;617-944-3700
212 pages;7 pages of Index & Contents
ISBN 0-201-50369-7 hardbound;$37.75

Half a dozen case studies make up this book. They're all about actual working projects in object-oriented design and programming, each told by people who were in on the work.

Five object-oriented languages are principally involved. Objective C was used in two of the projects; C++, Smalltalk-80, Objective Pascal, and Actor in one each. But readers don't need to know any of these languages to profit from reading this book. The case studies are at least as much about system design as about actual programming, and the individual languages are most often discussed in the context of explaining just what significant features they have and how those features work.

It's necessary to be well versed in general programming and the basics of object orientation. The case studies assume this knowledge in the reader, and what they have to say won't be of much interest to anyone not involved in software development at a rather close-in level. And it's definitely helpful to have at least a reading knowledge of the structured languages from which most of these object-oriented languages are extended: C in four cases and Pascal in the fifth.

These case studies are far more explanatory than narrative. There are a lot of diagrams and illustrations, including a number of color plates. A substantial amount of code appears, mostly as fragments that are discussed to one degree or another in the text. About half the studies offer bibliographies, and all of them end with conclusions about what was learned as a result of the work.

Review Highlights
Technical Level: Advanced to Theorist
Understandability: Lucid
Summary: Focused shop-talk for object-oriented programmers and serious wannabees. ■

Editor-at-Large Walter Zintz is the Advisor Emeritus to Uni-Ops Books in Boonville, Calif.

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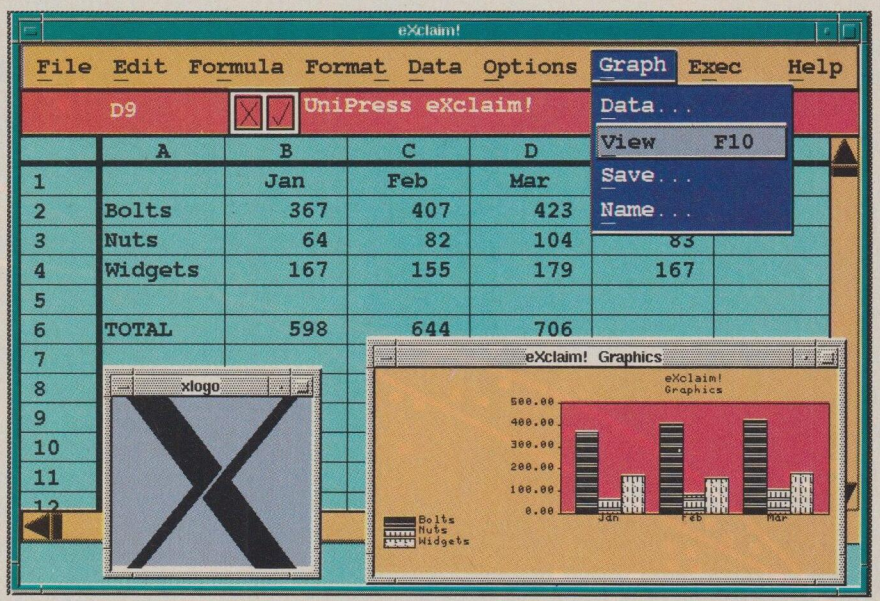

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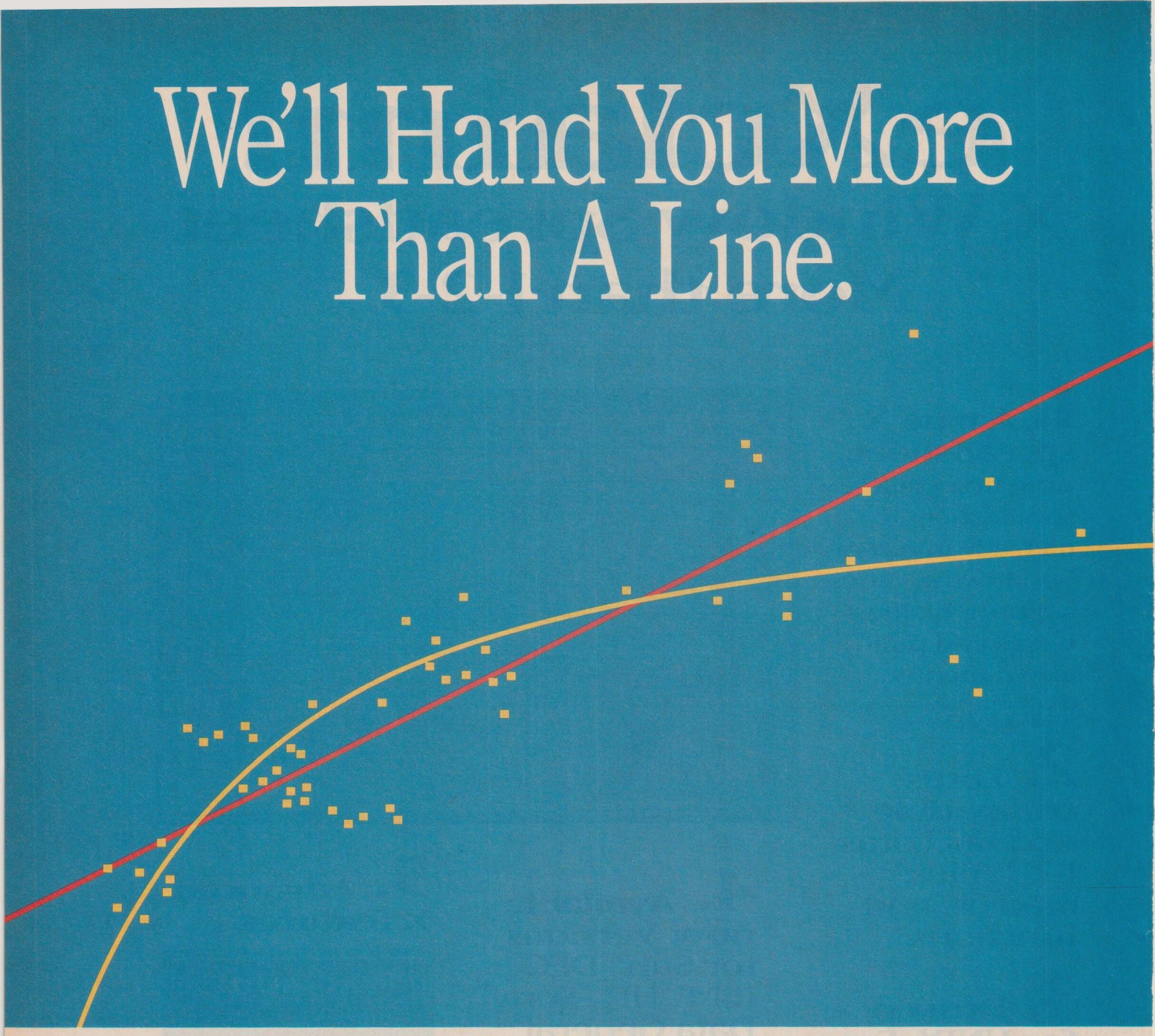

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OPEN SYSTEMS LEAVE THE TWILIGHT ZONE

Consider if you will, the open systems world of the future: your applications software runs on multiple hardware platforms from a variety of vendors, sometimes without recompilation. But more than that, your software modules are interchangeable. For example, if your database system no longer serves your purposes, it can be replaced with another such system from another vendor, without impacting the rest of your software.

A pie in the sky, you say? An idle pipedream? Don't be too hasty. The notion that the ultimate meaning of open systems is closely linked with the ideas of software module interchangeability, not to mention portability across hardware platforms, is increasingly being accepted by end users, third-party software suppliers, and system vendors.

Software interchangeability will become real when the functions of each module, and the interfaces between the various modules, are defined by industry-consensus standards, and when software suppliers begin providing products that comply with such standards.

It could be argued that software interchangeability is the logical culmination of the open systems trend. Thirty years ago, vendors offered point products, each with its own unique architecture and operating system. With the System/360 in 1964, IBM introduced the idea of a single architecture extending across a wide spectrum of performance levels. In 1977, with the VAX line, Digital Equipment Corp. followed suit and improved on the concept by offering a single operating system across the line. Once committed, the user still had no choice of vendors, but at least could scale up and down, nominally with no impact on applications software.

Then the International Standards Organization's seven-layer Open Systems Interconnection (OSI) stack came along, with the idea of offering interoperability among heterogeneous systems. These systems are not required to have anything in common, except for supporting the OSI communications model. OSI interoperability is now close to an accomplished feat, with most vendors, including IBM and DEC, offering OSI support. Even AT&T's System V will offer OSI support sometime this year.

When UNIX came along, it significantly extended the promise of portability across incompatible hardware platforms from a variety of vendors, giving users important new flexibility. Still, it is now widely recognized that true application portability, even at the source level, requires standardization of the entire computing environment, not just the basic operating system kernel. Such a standard environment is the object of X/Open's CAE (Common Applications Environment), the Open Software Foundation's (OSF's) AES (Applications Environment Specification), and even IBM's SAA (Systems Application Architecture).

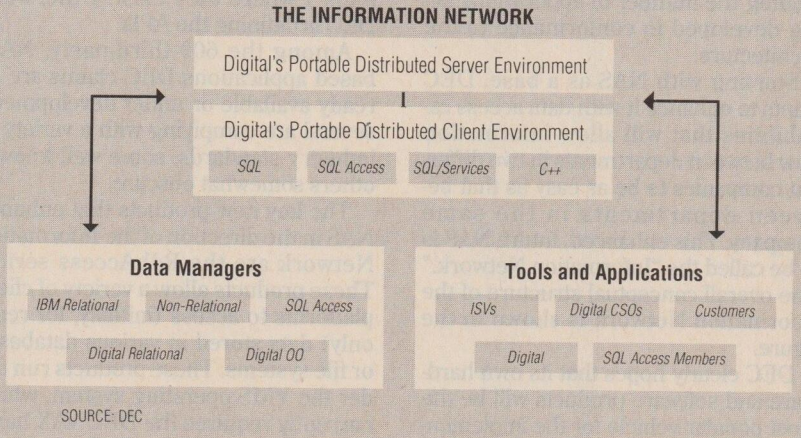
Now the stage is set for the next logical step: assuring not just application portability, but also interchangeability among the components that make up the standard environment.

We are already moving towards this goal. For example, the evolving X/Open Distributed Transaction Processing (DTP) set of standards stipulates the existence of such interchangeable components and defines the format and function of the interfaces between these modules, in addition to the interface between the application and the standard modules.

continued

Tuning In the Information Network

DEC hopes to evolve its current Network Applications Support (NAS) architecture to the point where, as the standards-based Information Network, it will allow information flow between departments in separate companies to be as easy as between equivalent departments in the same company.



SOURCE: DEC

DEC Gets with the Program with NAS

In its recent announcement of its Enterprise Integration "grand vision," DEC intimated that it, too, is beginning to subscribe to the interchangeability concept. David Stone, vice president of software products, presented a chart that defined the evolution to open systems, pretty much along the lines outlined above. Stone's chart, too, presented the idea of standard interfaces as the logical end-point in the evolution towards portability and interoperability.

Grand visions are intellectually satisfying, but their practical implementation must deal with the realities of how one gets from the present to the promised land. This generally means that one must start with what is actually available, and proceed to fill-in the blanks with plans for future products that get closer to the intent of the grand goal. The DEC plan is no exception to this rule. It also starts with existing products that are targeted first at achieving portability and interoperability.

The key current weapon in DEC's arsenal is NAS, the Network Applications Support concept. DEC likes to think of NAS as its answer to IBM's SAA; indeed, DEC views NAS as substantially ahead of SAA in several respects, including the number of applications being developed in conformance to the architecture.

DEC hopes its own products will be the most popular vehicles for implementation of the Information Network

Starting with NAS as a base, DEC wants to enhance it with data access capabilities that will allow information flow between departments in two different companies to be as easy as that between departments in the same company. This enhanced, future NAS is to be called the "Information Network." The overall conceptual structure of the Information Network is shown in the figure.

DEC clearly hopes that its own hardware and software products will be the most popular vehicle for the implementation of the Information Network. However, this network aims to allow a variety of heterogeneous clients to access data residing in a variety of heterogenous databases and file systems. And, the components of the Information Network will conform to standards: DEC specifically indicated it is moving towards X/Open's XPG3 and OSF's AES 0 conformance.

Because NAS is the cornerstone of DEC's strategy, a brief look at what NAS actually stands for is worthwhile. In the NAS concept, which DEC initially announced in January 1988, a variety of client-type platforms on the one hand (including VMS, UNIX, MS-DOS, OS/2, Apple Macintosh, and DEC VT, X Windows, and IBM 3270 terminals) communicate through the NAS "gray zone" to three classes of server-type platforms: DEC's own VAX and RISC systems, IBM platforms, and vendors with OSI-compliant systems.

NAS software encompasses four categories, which address the four major elements important to every application: users, other applications, data, and the underlying system. The categories are:

- Application Access Services: Define the way users and applications access other applications.
- Communications and Control Services: Allow users and applications to communicate within an enterprise and between enterprises.
- Information and Resource Sharing Services: Allow users and applications to share network-wide information and resources.
- System Services: Define the way applications interface to their operating systems environment.

The key goal of NAS is to establish application programming interfaces (APIs) in these four categories, preferably industry-standard ones ("open systems") where they exist. Otherwise, DEC is defining the APIs.

Among the 600 third-party, NAS-based applications DEC claims are already available or under development, several are complying with a variety of industry standards, some well known, others somewhat obscure.

The key new products that enhance NAS in the direction of the Information Network are the RdbAccess series. These products allow a variety of client platforms to access (initially, for read-only) data stored in various databases or file systems. These products run under the VMS operating system, which currently requires the DEC VAX hardware as the underlying platform. In the future, that restriction may no longer apply. If DEC elects to re-cast VMS in a high-level language, in preparation for running it on a RISC platform (see last month's column), then VMS could be ported to other platforms as well.

The current line-up of RdbAccess products includes RdbAccess for RMS, allowing direct, read-only SQL access to both DEC's RMS and IBM's VSAM file systems; RdbAccess for Oracle, providing direct, read-only SQL access to Oracle databases, residing on either the local or remote VMS systems; and the RdbAccess VIDA, permitting direct, read-only SQL access to IBM DB2 databases. The latter is an existing product, renamed to fit in the RdbAccess family.

It will be interesting to watch as DEC fills in the blanks of the Information Network grand design

Access afforded by these products can be interactive or embedded SQL. The data definitions of the foreign databases need to be incorporated in DEC's own CDD (Common Data Dictionary), but that can be done easily, DEC says.

On the client side, the permissible SQL-issuing clients include DOS and OS/2, Ultrix on DEC VAX or DEC RISC platforms, Apple's Macintosh, and, of course, DEC's own VAX-VMS systems.

These are clearly relatively modest steps in the direction of the Information Network grand design. It will be interesting to watch as DEC fills in the blanks in the design, not just because of DEC's position as the number two computer vendor. The problem that DEC is trying to solve with this strategy is how to cater to the open systems trend while maintaining the competitive advantages of proprietary products. It is a problem with which all computer vendors are currently struggling. DEC's success or failure in dealing with this issue will have broad, industry-wide implications. ■

Editor-at-Large Omri Serlin heads ITOM International Co., a consulting and research firm based in Los Altos, Calif.

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chapter 15 THE DISAPPEARING RAIN FORESTS

Most tropical forests form a green band around the earth's center extending roughly 10 degrees north and south of the Equator. Amazing as it may seem, these forests occupy less than eight percent of the Earth's entire land mass, yet they account for nearly half of all the growing wood on the planet and are the home for two fifths of Earth's animal and plant species. It is because of the amazing diversity of species that the rain forests are so important to mankind for we rely on these for agriculture, medicine, and industry.

15.1 Natural Source of Products

At least a quarter of all pharmaceutical products are derived from tropical rain forests. An even more impressive statistic when you consider that less than one percent of all Amazon plants have been intensively examined for their medicinal properties.

Tropical rain forests have provided man with treatments for leukemia, Hodgkin's disease, breast, cervical, and testicular cancer as well as a wide array of analgesics, antibiotics, heart drugs, enzymes, hormones, diuretics, anti-parasite compounds, ulcer treatments, dentifrices, laxatives, dysentery treatments and anticoagulants. Of the 90,000 plant species in Latin America, only 10,000 have been tested for anti-cancer properties. Scientists expect that at least ten percent of the untested plants will reveal some form of anti-cancer activity. A species of alexa tree, found in the northern Amazon basin and Madagascar contains the plant alkaloid castanospermine which is being studied at St. Mary's hospital in London as a possible treatment for forms of AIDS.

Vast quantities of rubber from the rain forests provide such mundane items as tires, gum, and running shoes.

15.2 Thousands of Diverse Species

The rain forests are the most complex and diverse ecosystems in the world. A one and a half hectare of rain for-

Figure 15.1 From 1950 to 1975, the amount of the earth's surface covered by tropical rain forest declined 15% to 12%. It is predicted to decline to 7% by the year 2000, and to 4% by the year 2025.

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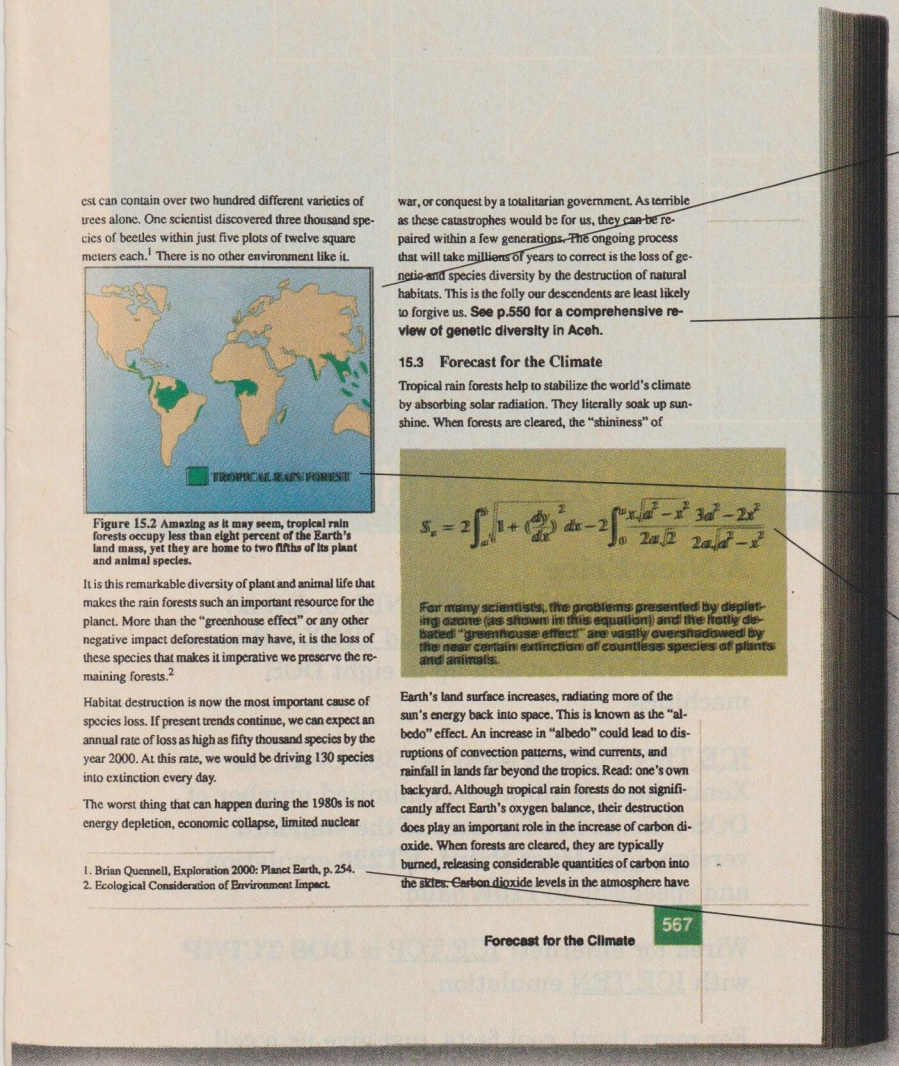

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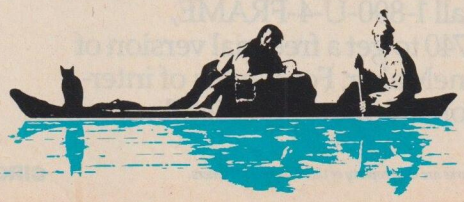

THE SON ALSO RISES

By Howard Baldwin

The question Doug Michels is most frequently asked is, "How do you like working with your father?" As executive vice president of stuff (that's what it says on his business card) at The Santa Cruz Operation, the $100 million supplier of UNIX and UNIX-based applications for Intel-based PCs, Michels wishes he could exile the question to a "frequently asked questions" list like the one on Usenet.

Let's set the record straight. First of all, Larry Michels didn't hire Doug when The Santa Cruz Operation was established in 1979; they formed a partnership. "By the time we formed SCO, I had already been self-employed and had my own employees for three years," says 36-year-old Michels. Actually, it was four years, if you count his senior year at the University of California at Santa Cruz. That was 1976, when he spent less time in classes and more time running a programming business, subcontracting work to three other UCSC students. "Hey, I graduated," he insists.

He's been graduating ever since–from programmer and consultant, to SCO founder and product developer, to founding member of /usr/group (now UniForum) in 1980, to president of the organization in 1989. Now he speaks about UNIX as a sort of ambassador-at-large, engaging in his own brand of shuttle diplomacy.

Ironically, Michels never intended to work either for or with his father. "The whole business started somewhat accidentally," explains Michels. "It happened one decision at a time." First of all, The Santa Cruz Operation is based in Santa Cruz because Doug left home in southern California to attend the university. Larry–which is what Michels calls his father–followed later, splitting off from TRW to work as an independent management consultant. When there were projects that required software development, Doug would get involved. The evolution was a formal and complementary business relationship.

continued

LUIS DELGADO

"Being the boss' kid is a fate worse than death. It's a role that you've got to be really sick to enjoy."

—Doug Michels,
executive vice president,
The Santa Cruz Operation

It was not, however, the first time he'd worked with his father. As a youngster, he'd hang out at his father's office. "My father was an entrepreneur and working 100 hours a week," Michels recalls. "If you wanted to see him, [you had to] go down to the office on Saturday, hang around, and play with the soldering irons." Later, during high school and college, he had summer jobs at his father's office, doing tasks as menial as emptying wastebaskets and as technical as writing programs.

He never intended to continue the activity. "The whole notion of working in your father's company...was absolutely something I was never going to do. Being the boss' kid is a fate worse than death. It's a role that you've got to be really sick to enjoy. You have all the disadvantages of a father-son relationship, the extra stress [that comes] from the baggage of that other relationship." He adds by way of self-mocking example, "You yelled at me like that when you were trying to teach me how to drive!"

Not to say that Doug doesn't do things that aggravate his father. "Doug excels at the conceptual," says Larry Michels. "And then he excels the other way, as an auditor. If you give Doug a program or a design or a deal to review, he can ask the most profound questions. And then [he has] the amazing ability, when you walk in with something where everything's [been worked out], he'll look at it for two seconds and bing, bing, bing, bing, find out what's wrong."

Their relationship intrigues Michael Tilson, who was president of HCR Corp. until SCO acquired it last year. Now Tilson is vice president of SCO Services, SCO's consulting division. "You see the arguments that two partners would have about how to run the business, but then you'll suddenly see that [father and son] tie. They're both strong personalities. I speak of both of them together because there are so many similarities between them."

If that's true, then maybe what seem like arguments to outsiders are really just Socratic discussions between two guys who love to debate. "One of the things I enjoy doing more than anything," confides Larry, "is going up to Doug and saying, 'Doug, tell me about something.' He says, 'What do you want to know?' I'll say, 'I want to know how such-and-such works.' And he'll go through an explanation. Then I'll say to him, 'That doesn't make sense, there ought to be situations where that won't work.' These conversations can go on for hours. I'm sure both of us come out in entirely different places from where we started."

Fundamentally, Doug Michels insists, he doesn't compete with his father–they share the same goals for the company, but they may disagree on how to achieve them. And there are advantages. "You don't have the competitive relationship that a lot of partnerships have. You don't worry whether you can trust your partner or whether he's trying to steal your money. There's an innate level of trust that comes from being family and knowing that essentially the assets of the company are family assets."

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percent of the shares are held by Microsoft, and the rest are owned by employees, private investors, and members of the Michels family. What kind of repercussions would a stock offering have on Michels? "I don't think it would have a big impact," he shrugs. "An IPO just makes it easier to figure out the value of the money you can't spend."

What he'd really like is a bigger plot of land than the three-quarters of an acre he owns now in the hills above Santa Cruz. There's not enough room for a stable to keep his horses, laments Michels, and if you squint through the trees you can still see the neighbors. "But at least I can turn the stereo on as loud as I want and nobody cares."

He acknowledges that an IPO wouldn't necessarily have to precede his buying a bigger house, "but it would probably make it easier. Mostly I just don't have time to look for it." He's home infrequently, travelling on business and for the UniForum board meetings and trade shows. His trips have been so extensive that he's reached the highest level of frequent-flyer heaven with United, American, and TWA.

Is that all there is to Michels? Just work? Tilson, who's known Michels since SCO's early days, thinks that if there's a private side to Doug Michels, it's revealed to very few people.

Quite simply, says Tilson, Michels is a workaholic. "Making SCO go is his life interest. He's been part and parcel of the company growing up through tough, scary times, and big successes."

In his expanded role as ambassador for UNIX, he sometimes finds himself talking to MIS directors who've only bought from IBM, who heard about UNIX once and think it's for scientists, who are still unclear on the concept of open systems. With these guys, Michels feels like the Indians must have felt when they first encountered the pilgrims. "It's like, we can help you grow corn."

Within the PC industry, among its developers and manufacturers, selling UNIX is a little easier, Michels says. Nevertheless, they still call upon him to provide a voice of reason amid the clamor of UNIX International and the Open Software Foundation, both of which insist they're the real UNIX answer. "It's become a point of religious honor where you shop for the flour to make your bread," he explains, adding that high-level people try to pressure vendors to buy only from certain sources.

He spends a lot of time convincing people that factionalism isn't going to destroy the industry. "Sometimes it's hard to convince people of that–especially when you're not so sure yourself. If I'm on any kind of crusade, it's to cut out the baloney and sell the benefits of open systems."

That's exciting to Michels. "It's exhilarating now," he says. "Until the last year, we weren't selling to Fortune 500 companies, but now we're into companies looking at ten-year strategic plans. They're saying, '[We need] interoperability and vendor independence and client-server architecture.' They're reciting all the benefits of open systems. And you start thinking, hey, we've got a story for these guys." ■

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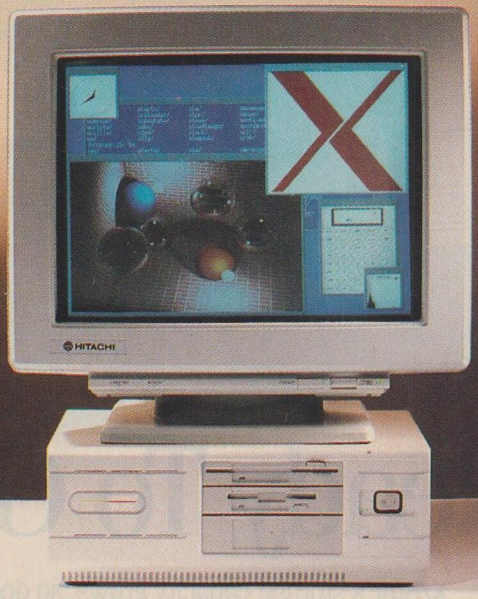

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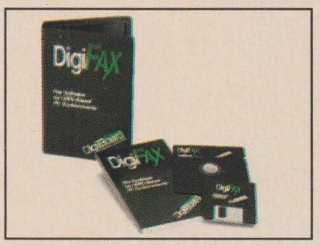

DigiFAX, from DigiBoard, is a PC based software solution that allows UNIX users to send faxes without leaving their terminals — no more frustrating waits at the fax machine. It also means improved quality, because DigiFAX eliminates the need to scan paper documents. Supports UNIX and XENIX. For info, call **1-800-344-4273.**

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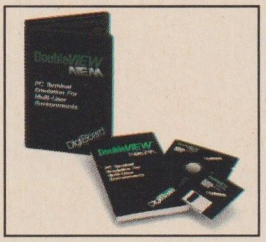

DoubleVIEW, from DigiBoard, is the terminal emulation package that automatically integrates PCs — even networked PCs — into multiuser systems. Users can hot key between DOS and UNIX sessions, transfer files, even "cut" and "paste" between DOS and multiuser applications. Cost of an eight-user package: under $30/user. For info, call **1-800-344-4273.**

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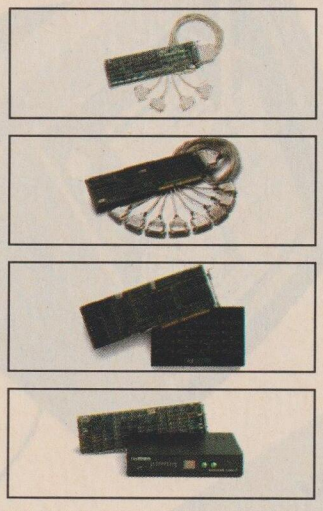

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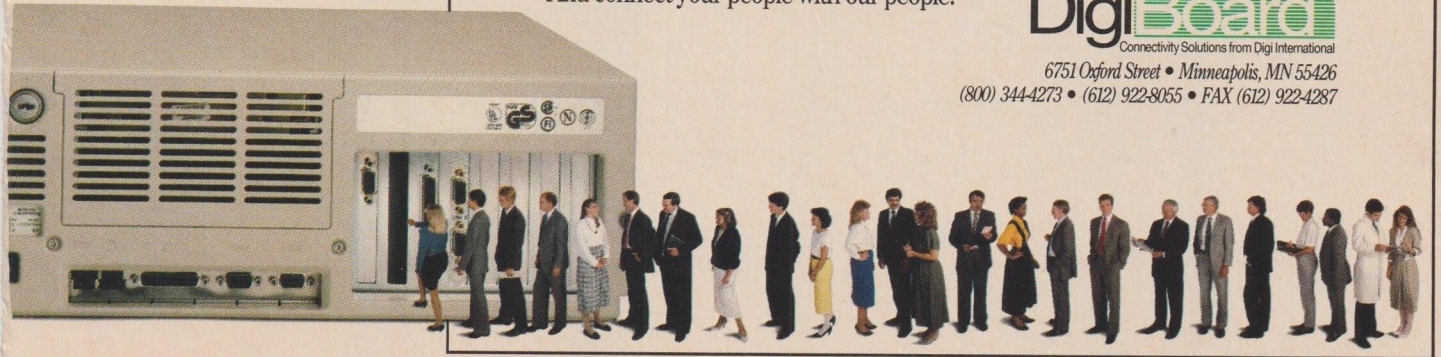

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CIRCLE NO. 254 ON INQUIRY CARD

Motif on Sun Workstations!

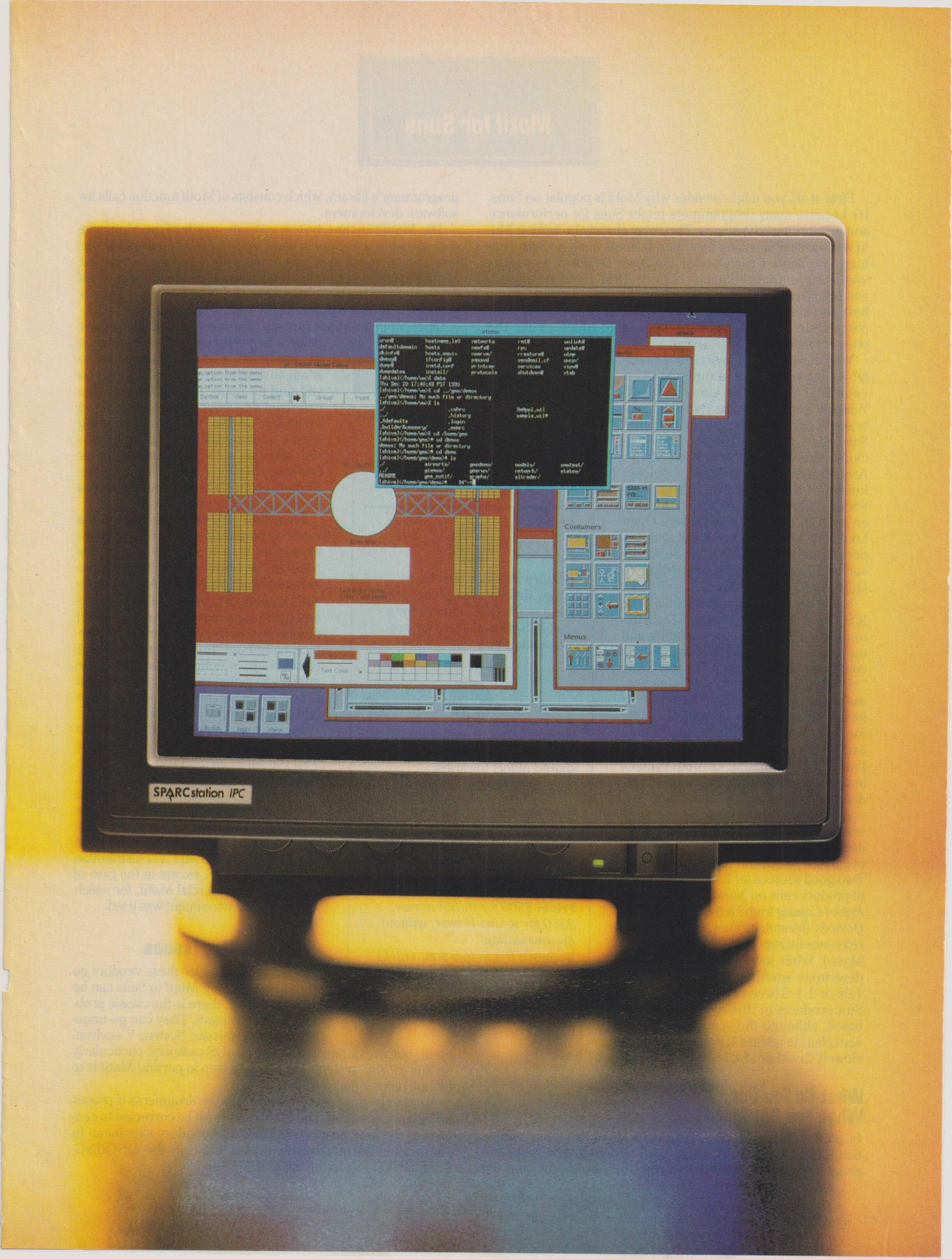
Vendors and users are doing their own ports or using products like these to write GUI-based applications

There's a new chapter in the ongoing saga of Motif and Open Look, the two popular graphical user interfaces (GUIs) for the X Window System. It's called "Motif for Sun," but it's not about how Sun Microsystems, the co-developer of Open Look, has finally decided to adopt Motif. Instead, it tells how Motif is stealing the loyalties of Sun users.

Sun doesn't support Motif on its own platforms, but several enterprising vendors have purchased Motif from the Open Software Foundation (OSF) and are reselling it. Their market is a burgeoning one, consisting of Sun workstations, and an increasing number of Sun clones. This article takes a critical look at four of these products and, in the process, answers some questions about porting Motif to different hardware systems.

continued

By Alan Southerton and Steve Mikes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Motif for Suns

First of all, you might wonder why Motif is popular on Suns. It's because many programmers prefer Suns for performance and networking advantages. They may already be writing Motif software applications for other systems such as 386s running The Santa Cruz Operation's Open Desktop, as well as systems from Digital Equipment Corp., IBM, Hewlett-Packard, and Data General. So to run Motif on Sun, programming shops have two choices: purchase Motif from OSF and do their own port to Suns; or seek out third-party Motif suppliers like the ones in this review.

Why doesn't Sun support Motif directly? As the co-founder of the rival Open Look GUI, which also runs atop the X Window System, Sun has refused to embrace Motif. It has been rumored that Sun balked at a large federal contract because the contract specified Motif. Around Sun quarters, Motif is politely known as the "M" word. This is a distinctly different approach than that taken by AT&T, which also prefers Open Look, but has announced it will also support Motif via the Quest products described in this article, according to Quest President Ted Kurts.

Sun is being stubborn. But vendors like ICS, Quest, IXI, and Unipalm XTech, not to mention some 16 other vendors and universities that resell Motif, want Sun to continue being stubborn. To them, the "M" word spells money. Ray Anderson, managing director of IXI, is certainly enjoying his secondary business in Motif for Sun. He says IXI is earning about $480,000 a year from supporting more than 175 sites running its Motif runtime and programming product. Other vendors would not disclose sales data.

As a consequence of these new products, many Motif applications originally designed for other systems are being evaluated to run under Motif for Sun. Two good sources for finding out if a Motif product runs on Motif for Sun are the *Export Catalog* from Network Computing Devices (Mountain View, Calif.) and the reference listings from OSF (Cambridge, Mass.). While investigating applications, determine whether they run on Motif 1.0x or 1.1. Three of the four Motif for Sun products in this review were 1.0x based, although the vendors had imminent plans to release 1.1 versions. The reviewed Quest product was already at the 1.1 level.

REVIEW HIGHLIGHTS

ICS OSF/Motif Developer's Kit
Integrated Computer Solutions
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Cambridge, MA 02139
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+

Includes Prentice-Hall Motif books. Reliable, excellent technical support. Free updates for a year. ICS-written Motif source code examples.

–

Version 1.02 and earlier implementations lack support for shared object libraries.

Version: *1.03*
Systems: *Sun-3 or SPARC-based Sun workstation, running SunOS 4.0 through 4.1, with X11R3 or X11R4 of the X Window System.*
Licensing: *Per user.*
Price: *$500 for initial license; $350 for second license, without documentation.*
Support: *9 a.m to 5 p.m. (EST). One-hour of free phone support for installation; other by contract.*

What Do You Get When You Get Motif?

In product form, Motif for Sun consists of two main components: the run-time environment, which non-programmers and programmers alike can use to run Motif programs; and the programmer's library, which consists of Motif function calls for software development.

The Motif run-time system consists mainly of the Motif window manager, **mwm**, and in some versions, shared object libraries. The run-time system comes with setup files to define Motif's run-time defaults to let users customize their Motif environment. Both the run-time and programmer's library products have been upgraded by OSF from version 1.0 to 1.1.

Once Motif for Sun is running, the only way to know you are using a Sun platform is by the logos on the hardware. If you are accustomed to Motif on another vendor's platform, you will find no noticeable difference. You can even run your choice of desktop managers on Motif for Sun, including Visix's Looking Glass and IXI's X.desktop. Mix this up with an application or two–say, Uniplex, Interleaf TPS, FrameMaker, or UIM/X–and working on a Sun is, as they say, transparent.

The Motif programmer's library is a more elaborate product. Programmers have more than 40 widgets at their disposal in the Motif widget library, hundreds of Motif function calls, a tremendous amount of printed and on-line documentation and manual pages, the Motif resource manager, and the User Interface Language. In addition, Motif 1.1 comes with an entirely revamped style guide, which makes up for past sins and is now more complete (as well as timely) than the Open Look style guide.

For each of the vendors mentioned in this article, the packaging contains a tape with the Motif for Sun run-time and development environments. In most cases, you also get thorough documentation. The test environments for the review were a Sun SPARCstation 1 and Sun-4/370 server, each running SunOS 4.1 and X11R4 from the MIT X11 distribution as supplied by ICS, except in the case of the Quest Commercial Motif, for which Quest's X11 environment was used.

Tricky Porting Issues

The actual mechanics these vendors go through in porting Motif to Suns can be tricky. To start, there is the classic problem of null pointers. They can go unnoticed in a permissive System V environment, but wreak havoc with the SunOS compiler, particularly on Sun SPARC systems. So, the first step in porting Motif is to fix null pointer dereferences.

Another porting concern for SPARC environments is proper boundary alignment. The Motif code must be corrected to conform to the local processor's rules for boundary alignment. In many cases, the only requirement is to specify the -DSTRINGS_ALIGNED flag to the compilation line.

There are also some SunOS-related porting issues before Motif compiles correctly on Suns. For example, when building the Motif toolkit, some modules must be compiled without turning on the native Sun compiler's optimization flag. If you use the flag, applications can core dump at run time.

The reason for this behavior is an application compiled with the optimized version of the Motif library routines only shows its bugs at run time–and only then if the defective Motif component is referenced. Because you are dealing with optimized code, the debugging information is not available to track the bug. When you recompile the application using the debugging flag (which results in unoptimized code), the bug disappears because the application is no longer affected by the native compiler's incorrect optimizing of the executable.

This type of bug tracking would require advanced development skills and the use of a debugging tool such as dbx or Saber-C. An example of a Motif component affected by this phenomenon was the Motif row-column widget, which has been re-worked in Motif 1.1.

Irregular Expressions

Yet another Motif porting issue unique to the Sun environment (particularly the SPARC platform) is that SunOS handles regular expression parsing differently than System V, because SunOS is based more upon the BSD UNIX variant. The Motif 1.0 source code, as delivered from OSF, simply did not work correctly in Sun environments. ICS, for one, solved this problem by using conditional compilation to invoke the current version of expression matching for the appropriate operating system.

Function prototyping doesn't always work well on Suns. When you don't prototype a function, the calling parameters can get "promoted" to type "int," rather than the real data type being passed. This can sometimes result in a core dump because of a corrupted stack for the program. To deal with this porting issue, simply turn off function prototyping when building Motif.

Although there are several more examples of Motif porting issues to the Sun platform, we won't go through them all. A last interesting quirk encountered in porting Motif to Suns is that when copying XmStrings to XmStrings, using the Motif library routines, frequently the target string would be one byte short. The only way it discovered these problems, says ICS, is it ran all of the Motif source code through the Saber-C.

OSF could resolve most of the Motif porting issues by adding Sun machines (particularly the SPARC machines) to its list of reference machines, because Sun hardware accounts for almost 50 percent of the installed workstations in the field. Another tip for porting any software to Sun machines is to do what the X11R4 installation documents suggest: use the Gnu C compiler, gcc, instead of the native SunOS C compiler. The Gnu C compiler performs correct optimization on Sun systems, and often produces more reliable and compact objects and executables than the native Sun compiler.

The components that make up the Motif environments provided by each of the vendors mentioned in this article include the Motif window manager (**mwm**), the Motif development and runtime files and libraries, the User Interface Language (UIL), the Motif Resource Manager (Mrm), the Style Guide, and development documentation. All of the functionality and "look and feel" of Motif found on all other OSF-supported platforms is present and fully implemented on each of these Sun versions. The evaluation criteria included overall packaging, cost, documentation, support, level of implementation, ease of installation, performance, and reliability.

Motif from ICS

Although it sells software products like other vendors, Integrated Computer Solutions has established itself as a credible vendor in X as sponsor of the annual Xhibition U.S. trade show, and founder of XUG, the popular X users group.

ICS's Motif comes in a run-time version and development version, although the distribution code is the same. Both versions cost $500 for SPARCstations and Sun-3 Motorola 68030 systems. Additional development licenses are $100 per system. Both systems support SunOS 4.0 or higher and X11R3 and X11R4. The documentation is a repackaging of five Prentice-Hall titles, which sell for about $150 in a bookstore. ICS's documentation is also available on disk.

Installing ICS's Motif for Sun is easy. Script driven, the 10-minute process worked exactly as printed in the installation booklet. The only thing you must do is modify the **.xinitrc** file to specify startup variables. Also include the Motif **bin** directory in your execution search path.

The major difference between the ICS product and the others in this review is the naming of one of the object libraries, **libXtm.a**, to prevent overwriting the **libXt.a** file. ICS did

REVIEW HIGHLIGHTS

Quest Commercial Motif
Quest Systems Corporation
2700 Augustine Dr., #242
Santa Clara, CA 95054
408-496-1900

Latest bug fixes applied to the product. Includes shared, debug and profiled Motif libraries. Motif environment includes 1.1(X11R4) and 1.03 releases. Provides capability of running Sun's OpenWindows 2 XView utilities under Motif.

Requires 75 megabytes of disk space. Every Motif user requires a license to use. Lengthy and complicated installation. License manager requires additional system administration effort.

Version: *1.1*
Systems: *Sun-3 or SPARC-based Sun workstation, running SunOS 4.0 through 4.1, with X11R3 or X11R4 of the X Window System. Vendor also supports 386 and 486 systems.*
Licensing: *Per user.*
Price: *$370 for Sun-3; $560 for SPARC-based systems.*
Support: *11 a.m. to 8 p.m. (EST)*
Warranty: *Software is warranted in accordance with Quest's Software License Agreement*

this to prevent the existing `libXt.a` from being replaced with the Motif version, which is based on OSF-modified Xt intrinsics. This affects the use of make files, in that the `libXtm.a` file should be included in place of `libXt.a`.

Motif on any other system, or from any other vendor, is still Motif. What really counts is the level of vendor support for the product. ICS has been around since the earliest days of X, and specializes in everything for X technology. In addition to Sun, ICS offers Motif for Apple A/UX, Amdahl mainframes, and DEC, Sony and Silicon Graphics systems, among others.

ICS provides quick turnaround on reported bugs and offers one hour of free telephone support for its Motif package. It also offers a standard support contract, priced at $1,500 for 15 hours of telephone support. The ICS Motif package includes source code examples developed by ICS. Because OSF sells source licenses, there was a constraint on providing OSF-supplied source examples.

ICS's OSF/Motif Developer's Kit is a bargain. If you use this package extensively, it will prove its value. The big plus is the set of Prentice-Hall books, but the important ingredient is ICS's technical support. The staff at ICS has demonstrated its expertise, not only in Motif, but in the entire X Window System.

Motif from Quest

The Quest-enhanced Motif environment is available in several different versions. The versions are Commercial Motif (wX11R4), Commercial Motif End-User, Motif Environment, and Motif End-User. Each product runs on SPARC, Sun-3, 386, and 486 systems. Pricing ranges up to $560 for the SPARCstation 1.

The main advantage of Quest's Motif environment is its shared object library support. Shared libraries are beneficial because they allow different applications to use the same code at run time, thereby reducing system memory usage and disk swapping. Quest offers shared object libraries for Xm, Mrm, and UIL. At this stage, however, not all applications use shared libraries. Instead, many are statically linked.

Quest Commercial Motif is the software developer's release, while the RunTime versions include only the bare essentials to support a Motif execution environment. The developer's release provides the shared object libraries as well as statically linked libraries. It also offers debug and profiled libraries, and support libraries required for Motif development. This is the equivalent of the ICS, XTech, and IXI Motif programming environments.

The Quest documentation consists of one set of reprints of the Motif 1.1 on-line documentation in 8 1/2-by-11-inch spiral-bound, soft cover bindings. The manuals include the Motif Programmer's Reference, Programmer's Guide, User's Guide, and Style Guide documentation. There is also a 22-page installation document.

It takes about an hour to install the Quest programmer's library, compared to an average of 15 minutes for the other products reviewed. Before you can complete the installation, you must contact Quest to obtain a license manager for your software. All of Quest's product line, including its enhanced X11 environment, is covered by this software lock, so only a single validation process (the license manager server) needs to run on the host system.

Commercial Motif is quite large, using more than 70 megabytes of disk. This is because the distribution includes the X11 libraries as well as the Motif components. After the license manager has been set up and the tape unloaded, there are a few additional system administration chores required (mainly having to do with setting up the license server) before you can finally begin. Quest provides one hour of free telephone support for installation. Extended support is by contract.

Quest's Motif has a built-in feature that permits execution of OpenWindows V2 utilities directly from within Motif. The OpenWindows applications retain their Open Look characteristics, such as their 3-D look and feel. The list of supported OpenWindows clients includes Filemanager, Mailtool, Printtool, Binder, Calendar, Tapetool, Texttool, and several others.

In addition to supporting the OpenWindows clients, Quest's Motif comes with sample source code and binary executables, including the standard Motif examples as well as the source code examples from Douglas Young's book on X programming, *X Window System: Programming and Applications With Xt.*

The Quest Commercial Motif environment provides full Motif functionality on Sun hardware, and also provides some nice enhancements, adequate documentation, and decent technical support. The feature of running OpenWindows clients in a Motif environment will be an interesting diversion for some programmers, but if you want to use OpenWindows, why run Motif to do it?

Motif from IXI

IXI Limited, which makes the X.desktop desktop manager, says it provides Motif for Sun because of demand from its customers. The IXI distribution package consists of the usual: a tape, documentation, phone support for installation, and some example applications.

continued

REVIEW HIGHLIGHTS

IXI Motif Environment
IXI Limited
62-74 Burleigh St.
Cambridge, CB1 1OJ
England
+44-223-462131
`Motif@x.co.uk`

+

Shared object library support for 1.0x. More than reasonable disk space requirements.

−

Only passable documentation. Vendor support for U.S. customers could be awkward due to tag-line phone system.

Version: *1.03a*
Systems: *Sun-3 or SPARC-based Sun workstation, running SunOS 4.0 through 4.1, with X11R3 or X11R4 of the X Window System.*
Licensing: *Per CPU.*
Price: *$495*
Support: *4 a.m. to 8 p.m. (EST), toll-free.*

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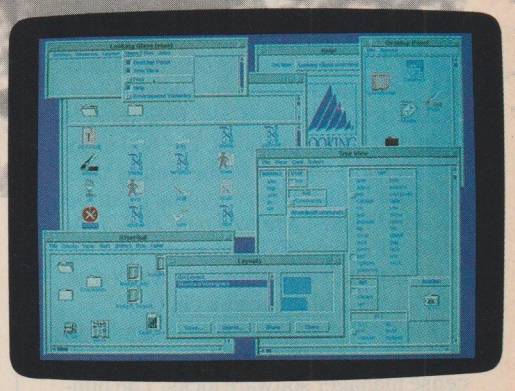

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The installation is script driven and took about 10 minutes before Motif was up and running. In addition to full on-line documentation for Motif, a small spiral-bound user's guide (it fits in a briefcase) was provided.

Shared object support is included for the Motif 1.1 version of the Xm, Mr.m, and UIL libraries. The same discussion on the benefits of shared object libraries for version 1.0x applies here as was previously presented.

This vendor, like Quest and ICS, also had to undergo the same porting concerns mentioned at the beginning of this article–producing an equally fast, reliable and fully functional Motif environment. All the standard Motif-based applications, such as FrameMaker 2.1, Island Write/Paint/Draw, X.desktop, X.deskterm, UIM/X, X-Build, Builder Xcessory, TeleUse, Synchronize, and several others (even remote Motif clients from other environments) worked equally well in this version of Motif.

The question for North American users is one of support, given that IXI is headquartered in Cambridge, England. IXI does not sell its Motif for Sun products through a U.S. distributor (as it does X.desktop). Missing this ingredient, IXI has set up an 800-number that routes calls to one of its offices, including satellite offices in Cambridge, Mass., and San Jose, Calif. If support is closed at these facilities, the 800-number transfers the call to the Cambridge, England office, where support can be obtained from 4 a.m to 8 p.m. (EST). At publication time, IXI also said it was negotiating with a vendor that wanted to distribute its Motif product in the U.S.

The pricing of IXI's Motif is similar to other Motif vendors and there are no license manager software locks. The bundled X clients were small in number, with no source code examples. In its 1.1 version of Motif, according to IXI, it is including source code for a sample program based on GNU Chess. All in all, chalk up IXI's product as another legitimate source for Motif on Sun hardware.

Motif from XTech

Of the four products reviewed, XTech's Motif is the least desirable. Although this might sound harsh, two things make it so: XTech's support policy and the lack of printed documentation.

XTech mandates that customers purchase support agreements before they can use the Motif software. This is true if they deal with XTech in Cambridge, England, although U.S. customers will find a much more agreeable support agreement offered through XTech's U.S. distributor, Aurora Technologies, in Cambridge, Mass.

For our European readers, beware. XTech's support agreement is automatically renewed annually and the customer must agree to pay the "prevailing rate" (unless the new rate is 10 percent higher than the previous rate), and customers must notify XTech 90 days in advance of termination of the support agreement. If you let the support agreement lapse and don't have a current version of the package, you must buy a new version (yes, with a new support agreement).

Motif from XTech also turned out to be the skimpiest of the evaluation packages reviewed. It consisted of a tape, some advertising literature, the licensing agreements, and a 4-page installation document (with errata sheet). There were no printed documents included. These can be purchased separately from XTech, or can be printed from the on-line documentation.

This Motif implementation also provides shared object library support, as do the IXI and Quest versions. Again, this issue is meaningless for most 1.0x users of Motif, because not many X applications make use of them. The performance was acceptable and the product was stable. Installation is script driven, and the environment requires only about 8 megabytes of disk space. Some standard Motif example applications are provided, but only in binary form.

Because this vendor is also located in the UK, it is prone to the same technical support concerns as IXI. There is a statement in the support agreement that the support window is limited to XTech's usual business hours.

Other than its higher price, the XTech Motif product is competitive. It has minimal disk space requirements and installs quickly and easily. The unconventional approach to software support, however, indicates that XTech is more interested in selling support services than in providing a high-quality Motif environment.

But then again, you can't knock XTech too much for emphasizing support. Each of the four vendors, as well as other organizations, acknowledge that support is vital to mastering Motif. The market will be the judge of fair pricing structures and quality support staff. In the meantime, these and other vendors are proving to the world that you can run Motif on Suns, with or without Sun Microsystems' endorsement. ■

Alan Southerton is this magazine's Product Reviews Editor. Steven Mikes is a published author of UNIX and X Windows programming books, and lectures on X/Motif/Open Look programming.

REVIEW HIGHLIGHTS

XTech Motif
Unipalm XTech
145-147 St. Neots Road
Hardwick, Cambridge CB3 7QJ
England
+44-954-211862

U.S. Distributor
Aurora Technologies
38 Sidney St.
Cambridge, MA 02139
617-577-1288

+ Shared object libraries. Good installation documentation.

– Must print your own manuals from on-line documentation. Mandatory support agreement outside North America.

Version: *1.03*
Licensing: *Per user.*
Systems: *Sun-3 or SPARC-based Sun workstation, running SunOS 4.0 through 4.1, with X11R4 of the X Window System, 386i.*
Price: *$695 for initial user; $249 for additional users.*
Support: *9 a.m. to 5 p.m. (EST). Support is available from Aurora and costs approximately 50 percent of the total original purchase price.*

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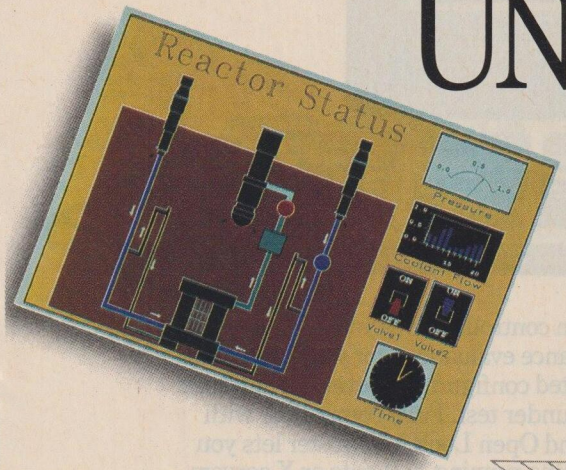

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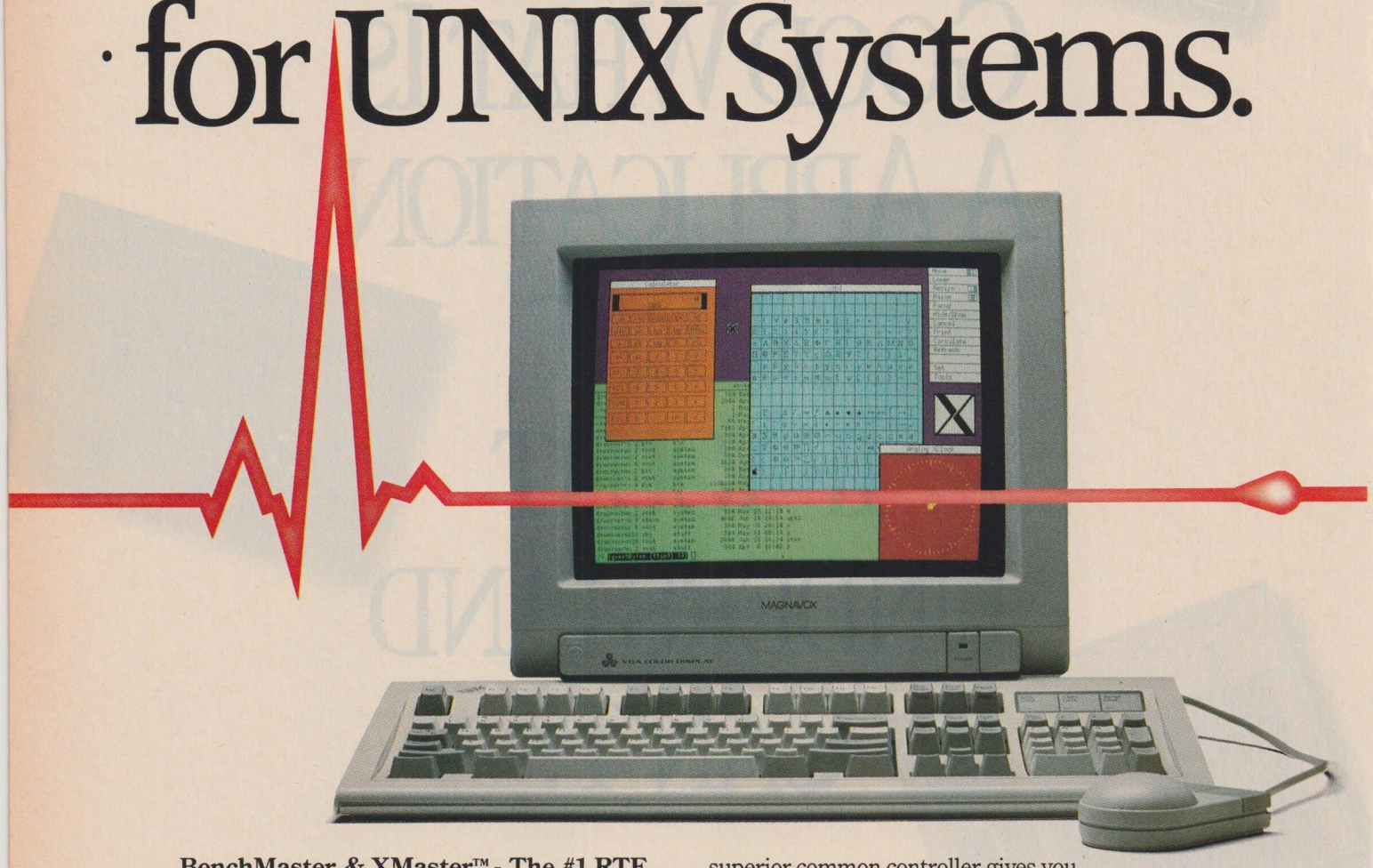

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CIRCLE NO. 58 ON INQUIRY CARD

NCR Under Seige

While AT&T rushes to NCR to solve its own profitability woes, NCR has plenty of its own troubles ahead

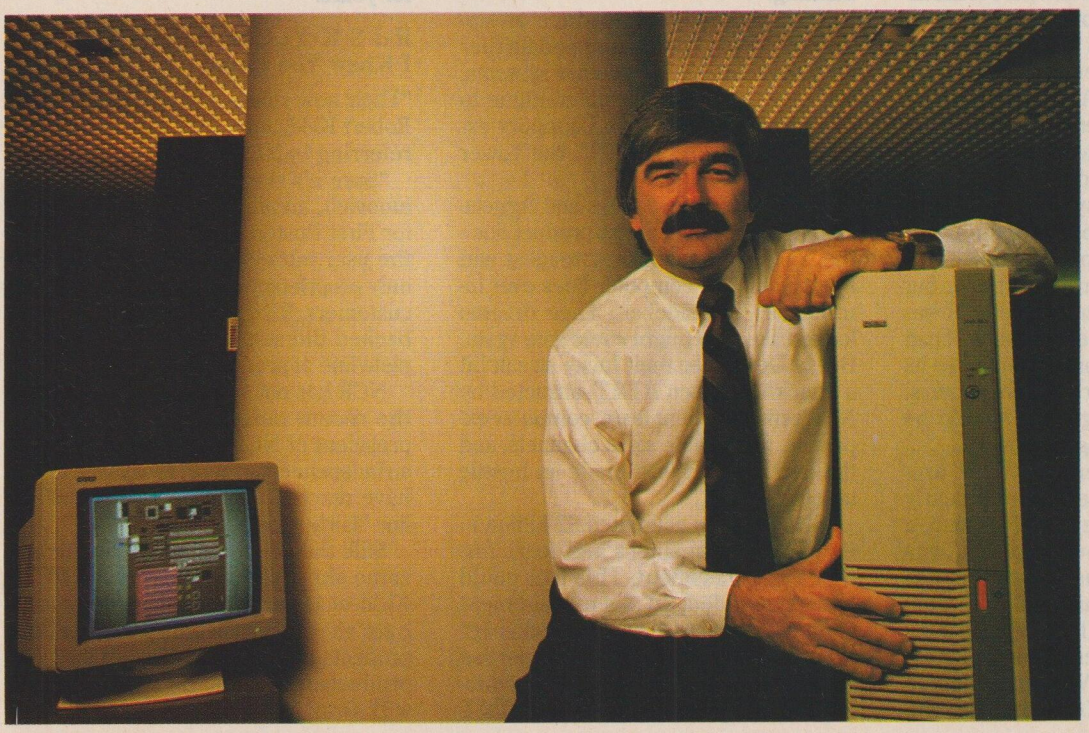
By Gary Andrew Poole

AT&T no longer wants to be considered the laughing stock of the computer industry. It wants to make a bold move for the future. So in December, it moved. It made a hostile takeover bid for NCR. Despite NCR's objections, that bid will ultimately be successful, analysts predict.

AT&T has always lumbered in its computer business. It hopes NCR can solve its years of dull products and falling revenues. In its haste to find a solution, however, AT&T has failed to notice that NCR now faces strife. After a year of internal changes and the announcement of one of the broadest and most ambitious product lines ever introduced in the computer industry, NCR will face at least two years of revenue shortfall as it waits for orders and tries to get the new line out the door on time, say analysts.

The attraction in the bid is also the poison. NCR looks promising to AT&T because of its new Intel 386- and 486-based 3000 line and the open systems networking strategy accompanying it. NCR is killing off its Motorola-based Tower line–its most successful UNIX machine to date. With this decision, NCR has chosen to reject reduced instruction set computing (RISC) technology. The move received warm reviews from industry watchers.

continued



BRUCE ZAKE

Tom Mays, senior vice president of NCR's general-purpose products group, shows off one system from NCR's hope for the future, the 3000 line. The future of the 3000 line, and NCR itself, depends on careful marketing strategies, continued consumer support, and the end-result of a hostile takeover bid by AT&T.

But the strategy has shaken NCR's foundation. In the last 12 months, NCR's all-out commitment to open systems has forced a revamp of management and sales forces to adjust for the new direction. NCR is a company ready to become more dominant. AT&T realized that. AT&T, meanwhile, has failed at every turn in its computer business. It might fail again, bringing NCR down with it. NCR can't implement a new strategy, which carries many risks, and fight with AT&T at the same time, say sources at NCR.

AT&T seems willing to take this risk. AT&T Chairman Robert E. Allen says AT&T's computer operations "weren't going to reach critical mass in time to be a significant player."

NCR's Chairman Charles E. Exley predicts failure if the merger occurs. In a letter to Allen, he says, "As I explained in detail to your board of directors, the history of mergers in the computer industry is one of disasters. The acquisition of NCR by AT&T would only add to a list of failures."

The Early Commitment

NCR's journey from cash register giant to computer power (and takeover target) started in the early 1980s. In a manufacturing plant known for its efficiency, two men sat dreaming. They dreamed about the future and how their then struggling 96-year-old company would fit into it. Ten years ago, these two managers at a NCR manufacturing plant in Columbia, S.C. decided to make the company an important part of the infant open systems movement.

Tom Mays (now a senior vice president for NCR's general-purpose products group) and Van Aggelakos (now an assistant vice president of NCR's multiuser products division) had a simple idea: a company-wide movement toward selling open systems products would lower its profit margins, but boost its overall competitiveness.

The idea wasn't accepted at first, but the flailing Dayton, Ohio-based NCR was laying people off by the thousands. It had to take a new direction or jeopardize its very existence. There were doubters. "Some people thought we should be committed," laughs Aggelakos.

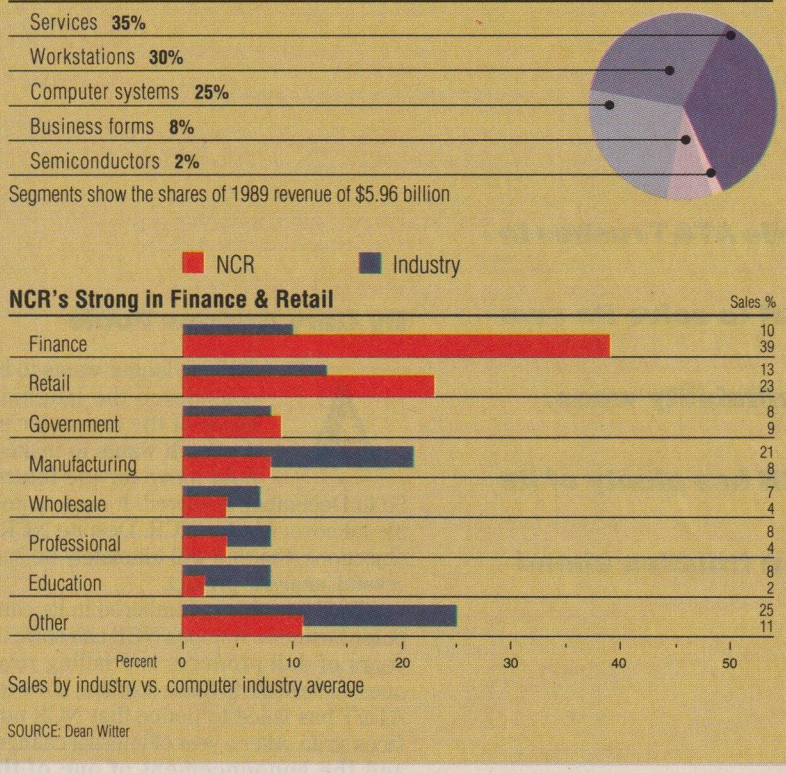
After long deliberation their proposal was finally accepted in the early 1980s. The venerable Tower System, a line of supermicrocomputers, was born. The impact the Tower line has had on NCR is monumental. Many analysts say the Tower has kept the company's computer operations profitable in the last few years. With an estimated installed base of 100,000 units, the Tower line is popular in retailing and banking.

NCR planned to introduce an upgraded Tower, but has stopped further developments on the popular systems. For now the company will continue to manufacture Towers and support existing Towers. But it's 1991, the Tower has fallen.

In recent months, Mays and Aggelakos dreamed about a new product line–the 3000 line, one of the broadest and most ambitious computer lines ever introduced. (See sidebar.) Their dreams looked like they might come true again. But in December their lucky streak hit a chuckhole when AT&T–attracted by NCR's management team, computer expertise, world-wide sales channels, and the new product line–made its hostile takeover bid.

AT&T lost an estimated $2 billion in its computer business and fears further embarrassment. This fear could be well-founded. NCR's management team threatens to leave if the takeover occurs, taking its computer expertise with it. The long process of introducing the new line could leave AT&T without any significant computer profits for years.

AT&T's Gotta Have It



SOURCE: Dean Witter

R-I-S-K-Y...Can You Say That? I Knew You Could

"Their new strategy is *very* risky," says Robert Kidd, an analyst with Dataquest, referring to NCR's new product line.

"Sure it's risky," counters Steve Milunovich, an analyst who follows NCR for First Boston, a securities firm. "But the user interest is there. NCR is the only proprietary company that's told its customers, 'UNIX is the way to go,' and backed the statement up with a complete line of products."

NCR has not surprised its users with the recent moves, says Jon Linden, president of NCR's UNIX User Group, an independent group. He says the users have reacted to the news of the 3000 line "fairly positively."

Still, the fall of the Tower line poses some short term problems for NCR. Kidd of Dataquest shares many analysts' view that NCR announced its new products prematurely. Most of the new products won't ship until 1992, which will sway potential customers away

Choose It and Use It.

Remember when you were a little kid? Put a penny in the gumball machine and wait to see what would roll out. Sure, you'd want the red one but it seemed like the green one would always appear. Until now, using a video display terminal was like buying a gumball. Cumbersome setup menus and complex commands would leave you hoping for one result but receiving another.

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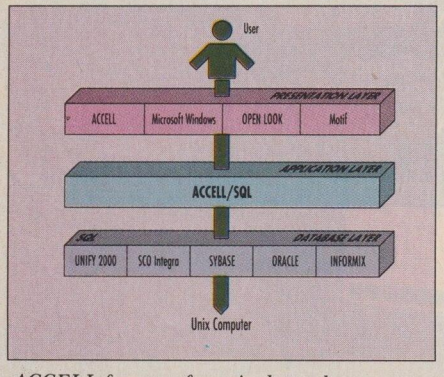

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from the destined-for-death Tower line and also from NCR.

"I won't be surprised if their Tower sales dive into a deep slump," he says. NCR expects this to happen and has started discounting its Tower products, but the short-term revenue shortfall could pinch its resources. Also, with a new product line, NCR has to retrain its sales force, which will take time and resources.

All of these negatives add up to a strategy that *is* (ummmm...) risky. NCR wants to move from a $6 billion annual revenue company to a $25 billion company by 1995. "This is an absolutely risky strategy," says Judith Hurwitz with Seybold's Office Computing Group, "but this is the day and age when playing it safe is as risky as a bold move. Other vendors are worried about losing their old client base, but NCR's strategy is for the future."

Betting the Farm on the System 3000

The System 3000 line that is now shipping aims to please. There are high-end desktops, floor-standing single- and multiprocessor servers, and yet more powerful floor-standing multiprocessor servers. Advance sales have gone well, say NCR officials, who refused to give out figures. Yet, the remaining four tiers of NCR's seven-tier 3000 computing platform won't be released for another year. That can seem like eons to many customers seeking solutions now.

The entire 3000 line runs AT&T's System V Release 4 and is based on the Intel chip set, which Tom Mays calls the "hub of NCR's development."

Intel was chosen "purely on its price/performance advantage and the access to application architecture," he says.

"Whenever a company moves to a different architecture it should be concerned," says Bob Vautrain, a senior research analyst with Gartner/InfoCorp. based in Acton, Mass. "But their customers want to move to Intel," he adds.

Some customers say they're interested in Intel because of its large number of software applications. Ronnie Anderson, chairman of the International NCR User's Group (an umbrella organization for the 34 independent NCR user groups), concurs. "Our members' first concern is software," he says.

NCR is philosophical about the shift. Company officials acknowledge the inherent problems with changing architectures, but contend that the RISC market isn't large enough to attract independent software vendors.

Some Tower users interested in buying systems from the 3000 line have expressed concern about compatibility. NCR officials say they'll provide migration tools so software applications can be ported.

Hewlett-Packard, one of NCR's competitors, says NCR made a serious mistake with this philosophy. "The price/performance of RISC is much better," says Bernard Guidon, general manager of HP's general systems division. He

The Great Hope: NCR's System 3000 Family

When someone asks Bill Eisenman, vice president of NCR's multiuser product division, about the pressure surrounding the success of NCR's new System 3000 computers, he doesn't blink an eye.

"We feel comfortable around here," he calmly says. "We're a cadre of people trying to aggressively build an end-to-end computer business. We're confident that we'll do it."

The System 3000 line has impressed analysts and users. It ranges in performance from 7.5 mips to more than 100,000 mips, and is designed so users can run the same application across a broad range of systems.

NCR is scheduled to deliver six models from its new line, including 386- or 486-based workstations, two multiprocessing servers and one scalable mainframe-class computer capable of using as many as eight Intel 50-MHz 486 processors. By the end of 1992, NCR will introduce one portable and two parallel-processing systems designed to match supercomputer-processing power.

Here's a breakdown of the models:

System 3300: High-end desktop systems. The released models are the 3320, 3340, and 3345. These models are high-performance workstations as well as entry-level workgroup servers. These machines use Intel 20-MHz 386SX, 25-MHz 486, or 33 MHz processors, which provide 7.5 to 27 mips. Memory options range from two to 64 megabytes with internal disk storage of up to 680 megabytes. Prices for the systems range from $4,000 to $60,000.

System 3400: Floor-standing single- and multiprocessor servers. The released models are the 3445 and 3450. The NCR 3445 is a server based on an Intel 33-MHz 486 microprocessor. It has memory options of 4 to 64 megabytes, SCSI up to 5 megabytes per second, and internal disk storage options of up to 3.3 gigabytes. The 3445 costs from $20,000 to $85,000. The NCR 3450 is an entry-level, multiprocessor server operating under the NCR UNIX SVR4 multiprocessing operating system. Scalable performance is achieved through the use of one to four Intel 50-MHz 486 microprocessors providing from 40 to 160 mips performance. The 3445 costs $35,000 to $200,000.

System 3500: More powerful floor-standing multiprocessor servers. The released model is the NCR 3550. The NCR 3550 is a symmetric, multiprocessor, computer system. The NCR 3550 uses NCR UNIX SVR4 multiprocessor operating system. The system uses from two to eight Intel 50-MHz 486 microprocessors providing 80 to 320 mips. Memory options range from 16 to 256 megabytes, with internal disk storage up to 13 gigabytes and external disk array capacities of up to 50 gigabytes. The system can support more than 1,000 direct of LAN connections. The system costs from $100,000 to $800,000.

Still to come: System 3100, a Windows-compatible portable; System 3200, entry-level desktop computers; System 3600, low-end parallel-processing machines; and System 3700, top-of-the-line parallel processing computers. —*G.A.P.*

AT&T: The WRONG Choice

NCR's Board of Directors has unanimously rejected* AT&T's predatory attempt at a hostile takeover because it is grossly inadequate and *not* in the best interests of our shareholders and other important stakeholders.

Now, we'd like to be left alone so that we can continue to develop and deliver the leading-edge products and responsive support programs you have come to expect from us.

Apparently, the folks at AT&T can't recognize a busy signal when they hear one.

NCR

NCR's fight against AT&T's hostile takeover bid included a series of full-page advertisements in the *New York Times* and other publications.

adds that NCR's choice of architectures won't jeopardize NCR's installed base, which is mainly made up of banking and retail applications, but its decision limits NCR to these niche markets.

Networking Strategy

NCR made gestures to expand into other markets. It hopes to sway other users with its networking software, which supports the System 3000 and also allows users to move to standards-based networking. The strategy also aims to quash fears from Tower users that the Tower is obsolete. The strategy is based around its Open Networking Environment, which is a set of products that provide a selection of Open Systems Interconnect (OSI) networking solutions.

The Open Networking Environment has four categories of products: a suite of OSI networking products; a group of SNA and TCP/IP software products for the System 3000 that allows OSI environments to co-exist with existing networks; a set of transitioning products that allows customers to access their old and new network environments while moving to standard-based networking; and an OSI-based network and systems management software product that spans the complete environment.

The Open Networking Environment seeks to move businesses from their current SNA and TCP/IP networks to the OSI network environment, says an NCR spokesperson. Users can run OSI applications and add other OSI capabilities as they become available, allowing them to migrate to OSI at their own pace.

Analysts have mixed reactions to the software. "There's a lot of sizzle, but not a lot of steak," says Robert Kidd of Dataquest, who says the plan is overly ambitious.

"This plan is well thought out," counters Hurwitz of Seybold's. "They've never been a great software company, but they did a good job, especially with the NCRNet Manager."

NCRNet Manager is OSI-based network and systems management software with support for OSI networks, SNA environments, and DOS, OS/2 and UNIX SVR4 operating systems.

NCR's user community also likes the product. "There's been a real positive response from users because they're concerned about networking their different systems," says Ronnie Anderson. "It's exciting to users and dampens some of their fears."

NCR's introduction of its 3000 systems and networking software has given NCR a renewed image of an open systems company, but its relationship with AT&T could hurt that image, analysts say.

No one at either company will give a description of how the merger would look. Charles Exley, NCR's CEO, fought the takeover bid. He told a United Press International reporter that if the takeover is successful he will "dump Open Look and the 3B [line]."

With a new product line, a networking strategy, and a defined direction, NCR aims to capitalize on its strong sales channels around the world. NCR has staked its future on the new line. Timely roll-outs for NCR will be especially critical.

In a time when large companies move like elephants, NCR took a bold move with its new line that can make or break the company. If the takeover succeeds, AT&T will be left to direct this new and difficult strategy. ■

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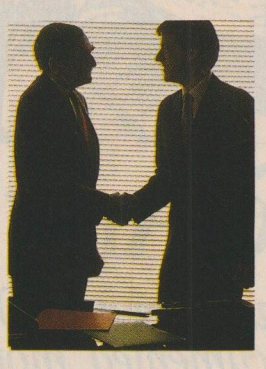

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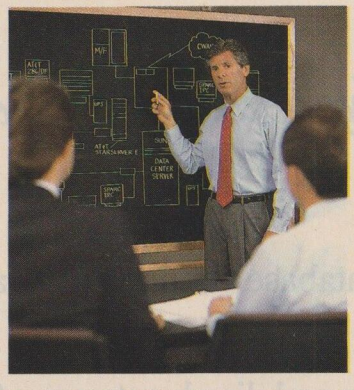

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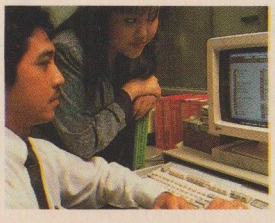

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CIRCLE NO. 125 ON INQUIRY CARD

DATABASE HELL

Are you trapped for all eternity by your database vendor?

Did you ever feel that when you signed your database vendor's software licensing agreement, you signed away your soul?

Choosing any piece of software has advantages and disadvantages, of course, and databases are no exception. But unlike word processors or spreadsheets, your database system is probably the most "business-critical" software you've got. It handles orders, billing, and the rest of a business's financial lifeblood.

And chances are you've invested plenty of time, money, manpower, and expertise in the applications you use to access and control the data in the database. When you have the support you need from your database vendor, you can get the maximum return from that investment.

continued

JAMIE HOGAN

BY FRANK HAYES

Database Hell

You've Got to Change Your Evil Ways

What if you don't plan to change databases right away? There are a few things you can do now that will make moving day easier when and if it ever comes. And you can do most of them in the course of normal software maintenance.

- If you use a 3GL for database applications, make sure your programs conform to current language standards. Standardized code makes porting easier, and it simplifies training new programmers.
- If your 3GL has a library of routines using embedded SQL commands, check those SQL routines for standards conformance, too.
- If you use a 4GL, consider shifting to a vendor-neutral 4GL, such as Focus or Accell. You'll get 4GL application-development advantages, without sacrificing your ability to move if the need ever arises.
- Consider doing a business requirements definition–the kind that would normally precede a database migration. You'll get a better picture of how well your current system meets your company's database needs, where potential problems lie, and how you can squeeze out more benefits with a minimum cost. —*F.H.*

When your vendor falls short, however, it can feel like a deal with the devil. Even with the best of intentions, database vendors lock in their customers in large and small ways. It's true of open systems environments, vendor-unique implementations, and extensions of query languages and programming tools. They can make the cost of changing database vendors seem insurmountably high–even if you're dissatisfied with the products, service, and support you're getting from your current vendor.

Are you really stuck forever with one database vendor if it turns out your vendor's products can no longer meet your needs? If you've ever considered that change, no doubt you've already felt the heat and smelled the brimstone. But how much hell you'll actually go through depends on the style of database you're using now, the tools you use for manipulating that data, and the decisions you make about taking care of your business information.

THE GATES OF HELL

Let's assume you have a darn good reason to change databases. If you currently use a UNIX-based relational database management system (RDBMS), you might want certain features that are not available from your current vendor, but are offered by competitors. Or maybe you're currently running under a proprietary system–say, a mainframe or minicomputer–and your company has decided to make the jump to open systems. Or perhaps you started small with PCs and a single-user database, and now you want UNIX's multiuser capabilities.

Wanting to move is a much different thing than actually moving, though. You have to move both your data–the actual information your business runs on–and the applications that juggle that data. But an information system is more than data and code. There are business issues that must be addressed as well.

Dan Cronin, vice president of marketing for the consulting firm SQL Solutions, says this is where many companies have the most trouble–weighing the business issues, not the technical ones. Hard questions must be answered before a database migration begins: "Over what time period do you want to release yourself from dependency on your current vendor? What will it cost to move off that engine over a period of time? Why are you moving? Architecture? Technology? To better leverage workstations? To capitalize software licenses?" Cronin asks. And there are political issues in every organization. For example, does a special business relationship dictate who your database vendor will be? "It pays to ask these questions up-front," Cronin says.

Do a business requirements definition first, Cronin advises, and then a cost/benefit analysis. That means calculating how much you've already invested in your current system–hardware, software, and training–and what it will cost to move. Your current investment includes not only the price of hardware and commercial software, but also specialized applications you've built and refined over the years. Training counts too–both the cost of training users and programmers on your current system, and the cost of retraining them for any new system.

You may also want to make other beneficial changes at the same time as moving your database, like purging outdated data from the system, reorganizing some data, or shifting some users from terminals to workstations. If you're moving from a non-relational to a relational database, it's much more expensive than a move between relational systems. That extra cost has to be balanced against potential benefits of an RDBMS.

Add up the total cost of your current system. How much more can you afford to spend on moving costs? Cronin warns that "people tend to overdramatize the dollar value." Spending 10 percent of your current investment isn't unusual for a move to a new system. "Maybe that's doable, if there's a solid reason," he says.

TAKING THE PLUNGE

Let's say you decide it's doable. You're moving from your current system (UNIX or not) to a UNIX-based RDBMS that will provide all the usual bells, whistles, hooks, and options–including client-server architecture, standardized queries through SQL, and both third-generation (C and Cobol) and fourth-generation languages for creating applications.

Ironically, the basic process is similar whether you're moving from another UNIX system, a proprietary system, or PCs. All three cases share some of the same problems, and all three have the same two fundamental tasks. First, you have to move your data to the new system. Second, you have to move the applications you use for handling that data to the new system.

Moving the data is comparatively easy. That's because the relational model is so common in modern database management

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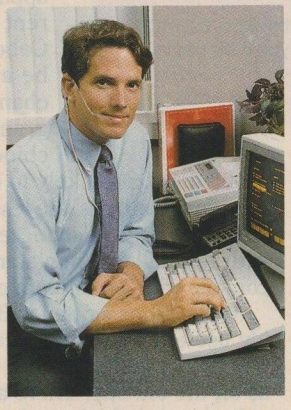

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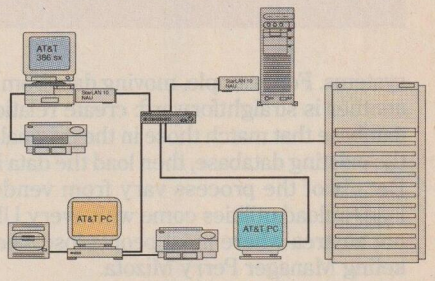

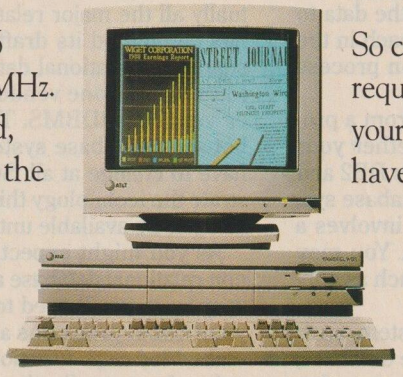

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CIRCLE NO. 251 ON INQUIRY CARD

Good Intentions

A few simple rules can help simplify your march down the road to potential database hell:

- Get help. A good consultant will ease this transition and help you make good plans for the future. Carefully check your consultant's experience and references. You can't afford to trust your business to someone who's not an expert.
- Plan ahead. Make sure you know what you want to change, how long you want it to take, and how much you can afford to spend.
- Outsource what you can. Don't reinvent the wheel–unless you'll be hopping among database systems regularly, don't collect expertise you don't need.
- Get your new database vendor involved. Often vendors have tools for porting your data or applications, and they always have a vested interest in getting your new system working smoothly.
- Look before you leap. Long before leaving your old system, test the hardware and the RDBMS. Port a few critical applications, and test them with sample data. Satisfy yourself that your staff will be able to handle the move.
- Follow through. Know your strategy and schedule, watch for checkpoints, and change the plan only when necessary. Get the job done right–or you'll be paying the cost of a bungled migration for years to come. —*F.H.*

systems. For example, moving data from one UNIX RDBMS to another is straightforward: create relational tables in the new database that match those in the original, unload the data from the existing database, then load the data into the new database. Details of the process vary from vendor to vendor, but the load/unload utilities come with every UNIX RDBMS. "This is not an area where most people lose sleep," says Sybase Marketing Manager Perry Mizota.

Ingres Database Product Manager Dave Kellogg points out that moving data is a little more complex when the different RDBMSs offer different data types. For example, your current database might have a single data type for numeric values, while your target system also offers integers, dates, and dollar amounts. You could simply ignore the new data types or you can use third-party tools to convert the data to make use of the new types–a more effective approach in the long run, but one that makes the data migration process more complicated.

How much more complicated is moving data from a proprietary system to UNIX? That depends on whether your current database is relational. For example, IBM's DB2 and Digital Equipment Corp.'s RDB are relational database systems; migrating from them to a UNIX RDBMS involves a similar "create tables/unload/reload" process. You may also have to perform translation for some data, such as converting EBCDIC text to ASCII.

Moving to an RDBMS from a non-relational system, such as IBM's IMS or DEC's RMS or even a PC flat-file database, is likely to be much more difficult. The data can be translated and moved, but a relational system also requires creating structures such as tables and indexes. That's not simple, and it's likely to be much more expensive in terms of time and effort. On a PC, the amount of data may be small and the benefits may be worth the cost. But on a mainframe-based system with huge amounts of data, you may want to consider other options, such as gateways. More on that later.

THE LONG MARCH

Moving the data is relatively straightforward–at least, the problems are predictable. By contrast, getting your application code to make the trek to the new database system is highly individual. The problems you'll encounter in trying to accomplish such a task will depend on how those applications were written and maintained.

If they were written in a conventional programming language such as Cobol or C–a third-generation language, or 3GL–it may be fairly easy to port the basic applications. If, for example, your current system uses a standard dialect of Cobol, a UNIX Cobol compiler should be able to handle the code with few changes. Of course, the more your programmers have used specialized, machine-dependent extensions, the more problems you're likely to encounter; the closer you've stuck to major standards, the less you'll have to change. If you've resisted the urge to squeeze out the last ounce of performance with specialized, non-standard techniques, your code may compile with a minimum of editing.

Applications written in 3GL for a relational database probably use embedded SQL commands. In that case, make sure the SQL commands work the same way on your new system as on the old one. There are many different dialects of SQL, only some of which conform to official standards. Even ANSI-standard SQL has options that can lead to incompatibility.

However, an industry consortium called the SQL Access Group has created a draft standard that should eventually lead to a "common SQL." The group, formed in 1989 by virtually all the major relational database vendors except IBM, has completed its draft of a common dialect of SQL to be shared by relational database systems. A common SQL dialect would let one vendor's applications easily talk to another vendor's RDBMS. This would radically simplify moving between database systems, because applications wouldn't have to change at all. SQL Access members plan to demonstrate the technology this year, but products based on it aren't likely to be available until 1992, at the earliest.

As you might expect, applications written in Cobol for a non-relational database are likely to be more eccentric. At the very least, you'll need to make sure data-access functions in your Cobol programs are performed through the library of embedded SQL functions. You're more likely to need a rewrite of your applications to meet the standards for Cobol and for relational database access. That's a much more complex process, and certainly a daunting one if you're trying to accomplish it in a short period of time.

Applications written for PC database systems such as Ashton-Tate's dBase have their own quirks. A language like dBase includes both database creation and application functions. It

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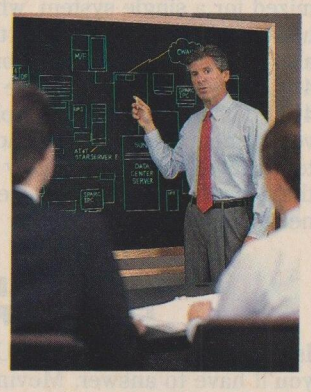

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CIRCLE NO. 108 ON INQUIRY CARD

looks something like a conventional 3GL, but there's often no version that works with a relational database system, which means a rewrite to a different language is mandatory. In addition, you'll probably need to rewrite such applications anyway to handle such non-PC requirements as multiple users and multiphase commit.

HELL'S BELLS AND WHISTLES

But the grand champion for creating a database hell is the fourth-generation database application language, or 4GL. These are specialized languages designed specifically for use with databases. They typically provide easy-to-use functions for creating terminal screens and accessing data. As a result, programmers using 4GLs can often produce applications much more quickly than their co-workers laboring away in 3GLs. A 4GL is also usually designed specifically for a particular vendor's RDBMS, and can take maximum advantage of all the system's bells and whistles.

That's the 4GL's most attractive advantage–and greatest disadvantage. Because they're designed for a specific vendor's system, applications written in a vendor's 4GL simply aren't portable. A program in Cobol may require significant editing; a program in a 4GL will require a complete rewrite. There are no standards for 4GLs. There's not even a trend toward standards. And every major UNIX database vendor we talked to agreed without hesitation that 4GL applications would require a rewrite.

Is the situation completely hopeless? No–just moderately hopeless. The same features that make 4GLs great for fast application development also make them good for fast application rewriting. Because you've already done the program design on an existing application, your rewrite will probably have the same general structure. And even if there's no one-to-one correlation between functions or commands in different vendors' 4GLs, the different languages still do some of the same things–display the contents of a field at a particular screen position, for example. But you're well advised to view the translation job as a rewrite, not just an edit.

There's one exception to that rule. While most 4GLs are designed to work with a particular vendor's UNIX RDBMS, vendor-neutral 4GLs such as Focus, from Information Builders (New York, N.Y.), or Accell, from Unify (Sacramento, Calif.), are intended to work with many different systems. Vendor-neutral 4GLs try to provide the faster application development that comes with a 4GL, but with versions for each major database vendor's system. This makes porting applications much simpler: you just transfer the application code, recompile if necessary, and run your programs. As long as your new RDBMS is supported by your vendor-neutral 4GL, you're in even better shape than users of 3GLs.

There's a tradeoff, though: vendor-specific 4GLs are optimized for a single system, while vendor-neutral 4GLs give up some performance for portability. On the other hand, it's also possible to run applications written in a vendor-neutral 4GL side-by-side with those written in a vendor-specific 4GL. That means you can "pre-migrate" applications to a vendor-neutral 4GL without actually changing database systems. Instead of immediately translating all applications to the new 4GL, you can rewrite your application code as the need and opportunity arises.

PITFALLS AND PITCHFORKS

Is it worth all that trouble? Ultimately, that's the question you'll have to answer. Moving to a new database system shouldn't be taken lightly. There's good reason to view database migration as a march through hell.

And migrating isn't likely to be inexpensive. The longer you've used your current vendor's system, the more likely it is that you've become dependent on it. You can take steps now to reverse some of that dependency, however, even if you aren't planning to change databases. ■

Staying Put

What if you *can't* move to a new UNIX database system? A co-existence strategy may give you the advantages of a new system without the cost of a complete migration.

If you've currently got a proprietary system, one alternative is a gateway. You set up a new RDBMS to communicate with your existing database system. The new system asks for data from the old system as it needs it, and updates data on the old system as each transaction is completed. The gateway software handles the details of where the data resides and any necessary data translation. The disadvantage: a gateway almost certainly won't provide data as quickly as having it on your own RDBMS. But it's an effective way to get access to the data, and it's relatively easy to implement.

Another option is running old and new systems in parallel, which can give you some breathing room, but means higher operating costs–dual software licenses and twice as much computer hardware. More critical is the problem of keeping the data current on each machine; you have to keep updating the data between machines, keeping them synchronized. The data will only be as fresh as the last time the systems were synchronized–say, once a day. If you require up-to-the-minute data, running in parallel won't work. —*F.H.*

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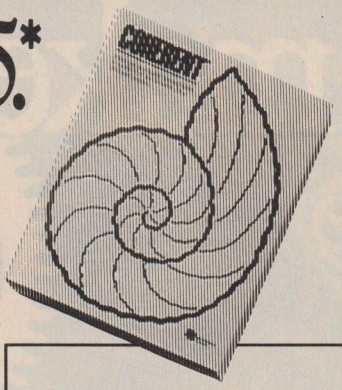

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No. of Disks	4	21
Kernel Size	64K	198K
Install Time	20-30 min.	3-4 hours
Suggested Disk Space	10 meg	30 meg
Min. Memory Required	640K	1-2 meg
Performance*	38.7 sec	100.3 sec
Price	$99.95	$1495.00

*Byte Execl benchmark, 1000 iterations on 20 MHZ 386. Hardware requirements: 1.2 meg 5¼" or 1.4 meg 3½" floppy, and hard disk. Does not run on Microchannel machines.

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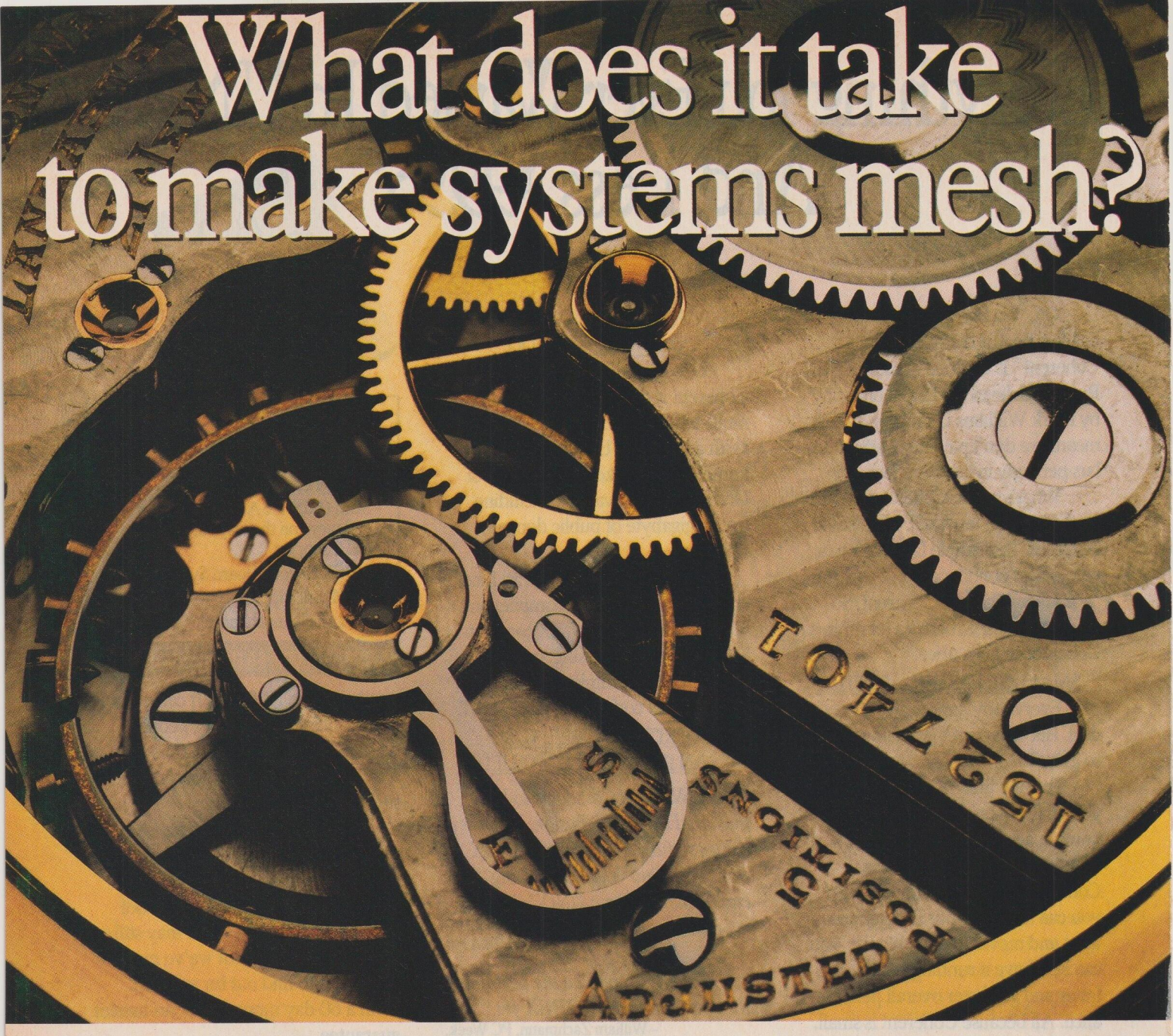

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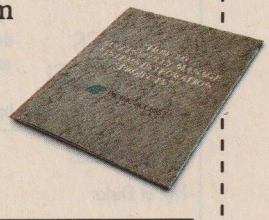

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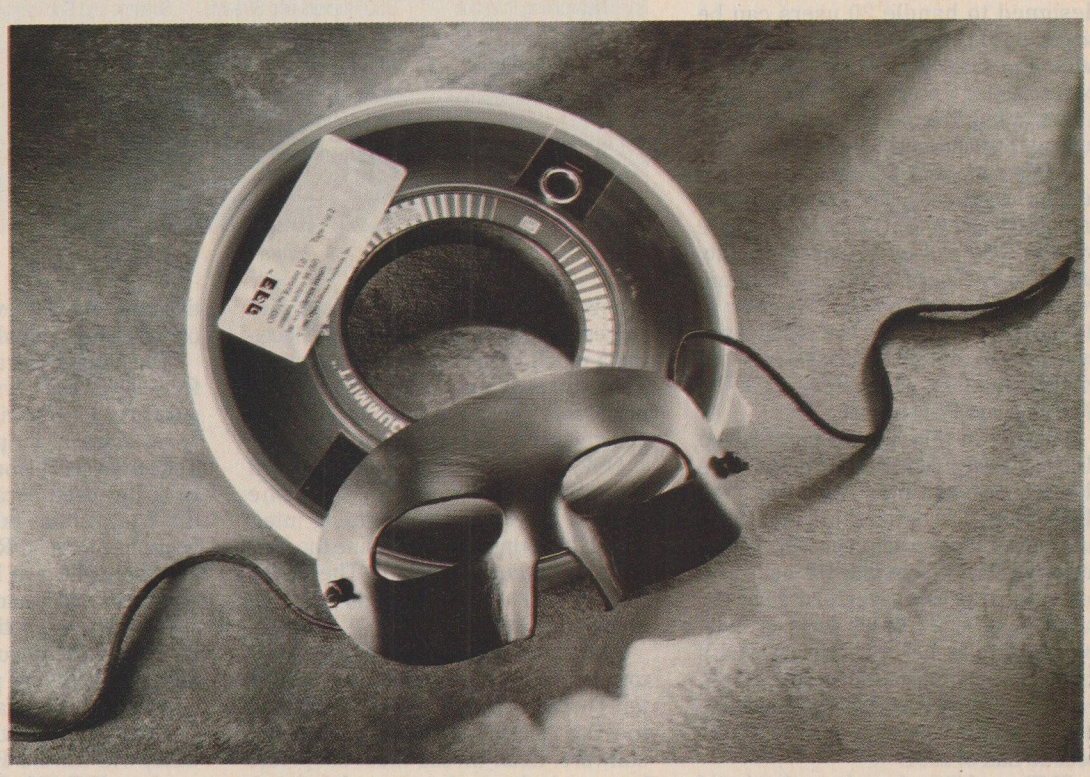
The Debut of a New UNIX

Upon examining the Open Software Foundation's new operating system, OSF/1, you'll find it's very much like one of the many UNIX variants based on AT&T's System V, with Berkeley enhancements.

That's good news for programmers, because software may port more easily. OSF/1's interface conforms to two application programmer interfaces: System V Interface Definition (SVID Release 3) and the latest X/Open Portability Guide (XPG3). Porting will be an important point, because even System V-based software, such as The Santa Cruz Operation's 3.2-based applications, will require porting because of differences in system call semantics.



ROSE HODGES

Then there are more subtle distinctions. For example, OSF/1 will be the first to provide an application program-level multiprocessing interface. Also, OSF/1 uses the Berkeley sockets networking interface, but SVR4 uses Streams libraries to provide a networking interface, with sockets as an option.

Still, on the issues of kernel-level multiprocessing, security, supported file systems, graphical user interfaces, logical volumes, internationalization, and memory-mapped files, both versions have strong similarities.

When the first snapshot of OSF/1 was released last October, the tape contained three reference ports made by OSF: Digital Equipment Corp.'s 3100 workstation; the Intel 386 microprocessor; and the Encore Multimax, using the National Semiconductor 32000 CPU. The snapshot is intended to show how other OSF members–notably Hewlett-Packard and IBM–can port OSF/1 to their own hardware.

You have to look hard to differentiate OSF/1 from its rival, AT&T's System V Release 4

By Rik Farrow

Despite the initial hoopla surrounding the founding of OSF, only DEC seems interested in providing OSF/1 any time soon (see sidebar). HP has promised to provide a port on one of its four workstation lines late this year, while IBM is planning to port to the entire AIX family, though it has set no delivery date.

Although OSF claims its operating system will be compatible with existing software, only one application, Informix Wingz, has actually been demonstrated. Application developers will be the first to work with OSF/1 when they decide to port software to computers running OSF/1. Unlike SVR4, OSF/1 provides no binary standards, so developers will have to support more ports than for SVR4-based computers with application binary interfaces.

continued

Right now, the acceptance of OSF/1 rests largely on the existence of applications running under it. Few vendors are willing to make the port without the support of hardware vendors.

Multiprocessing for the Masses

Some significant technologies will appear in OSF/1. The most heralded addition is a multiprocessing capability built into every OSF/1 kernel. Multiprocessing has become a critical issue as users and vendors have learned that adding processors to a system is an easy way to provide scalability. A computer that was designed to handle 20 users can be scaled up to handle many more users by adding processors, memory, and serial ports. Adding a processor is also seen as a way to improve performance without having to abandon an entire system.

Vendors receive OSF/1 with symmetric multiprocessing capabilities. Symmetric multiprocessing (SMP) means that the system load will be balanced equally among processors, unlike asymmetric versions, which force one processor to do more work. OSF/1 has parallelized system calls, libraries, file systems, the virtual memory subsystem, TCP/IP, Streams, and BSD sockets.

Missing in this list are parallelized device drivers, which are the software that actually talks to the serial ports and disks drives. The device drivers in OSF/1 are not multiprocessing–multiprocessing device drivers provide the next level of multiprocessing performance improvements. OSF/1's kernel-level multiprocessing is based upon its Mach kernel. UNIX International, the AT&T vendor advisory group, has promised to deliver an SMP version of SVR4 in the second half of 1991.

SMP capabilities have been developed previously for both System V-based versions and BSD versions of UNIX. OSF/1 has new user-level multiprocessing capabilities, based on threads. Threads give application programmers the ability to create applications with multiple, simultaneous, execution paths. In an ordinary, unthreaded program, there is one path of execution where, essentially, one list of instructions is followed. In threaded programs, each thread represents a path of execution that may be followed.

As an example, a database server application could be written to use threads to respond to each user's query. When the server receives the query, it dispatches the thread, and if there are multiple processors, the thread may be executing simultaneously with other threads. Dispatching a thread requires that the operating system allocate some memory for temporary use by the thread. Executing a new program, by comparison, involves reading a disk image and allocating a much larger amount of memory. Thus, threads are called "lightweight processes" because they are simpler and quicker to start up and manage.

OSF/1 uses the draft Posix standard for multiprocessing support, the 1003.4a Pthreads programming interface. UI is helping to determine the final draft of the Posix standard. The AT&T version of user-level threads won't be ready until 1992.

Although threads are an exciting new toy, they will also be a tricky one to master. Threaded software is more difficult to write and debug than non-threaded software. Each thread must cooperate because it shares the same global variables. Special routines are defined in the draft standard to prevent threads from corrupting shared data. Writing threaded software is similar to writing device drivers and is an art to be mastered by tomorrow's programmers.

B1 Security Issues

With the U.S. government providing much of the motivation behind the rush into open systems, security becomes an important issue for operating systems. OSF/1 uses SecureWare Inc.'s SMP+ (Secure Module Package Plus) product to provide Orange Book B1-level security. Security is designed into the OSF/1 kernel to be selectable at compilation time to either standard UNIX (C1), C2, or B1. In addition to B1, OSF/1 offers some features from higher security levels, such as least privilege (B2) and access control lists (B3). Auditing, which is activated at the C2 level, can be adjusted on a per-user granularity.

Security certifications are essential for selling UNIX systems to the federal government as it will require B1 security on many of its purchases by 1992. That may spell trouble for OSF members, however, because certification at the B1 level has taken more than two years in the past. Recently, the federal government's own National Institute of Standards and Technology has taken responsibility for certifying software from the National Computer Security Center, and the certifying process may be accomplished much faster.

AT&T SVR4, with its year-long lead time, will have a B2-certified secure product, SVR4ES (Enhanced Security), in the first half of 1991. The SVR4ES can be configured to provide lesser degrees of security, so it can be sold to any place that requires C2, B1, or B2 Orange Book security. Here AT&T has a slight edge. Also, vendors interested in SecureWare's SMP+ can license it directly from SecureWare for System V ports before SVR4.

SecureWare's SMP+ includes much of what you will find in UI's secure product. In particular, the password management in the vanilla SVR4 is very similar to SecureWare's Password Management System. This is not surprising, because both are based upon the U.S. Defense Department *Password Management Guideline*. The overlap in security features is expected because all products must conform to the Orange Book to succeed in certification.

One area of difference is SecureWare's

Selected OSF/1 and AT&T SVR4 Features

	OSF/1	*System V Release 4*
Multiprocessing	Encore Multimax SMP user level threads	SMP in summer 1991 user threads in 1992
Security	SecureWare level B1	SVR4ES level B2 in 1st quarter 1991
File Systems	System V, FFS, NFS, and customer defined	System V, FFS, NFS, RFS, /proc, and customer defined
Logical Volume	available	announced for 1st quarter 1991
Disk Mirroring	available	announced for 1st quarter 1991
Networking Interface	BSD Sockets and Streams from Mentat	Streams and Sockets on top of TLI Core OSI stack 1st quarter 1991
Graphical User Interface	OSF/Motif and X11R4	Open Look, OSF/Motif, NEWS X11R4
Internationalization	European and Asian environment	European and full Asian environment; multi-byte support; supports multiple languages
Portability	ANDF under discussion	ABIs for Intel 80x86, i860, Motorola 68000 and 88000, WE32000, MIPS, and SPARC

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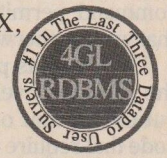

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Trusted Application Programming Interface (TAPI). The TAPI is used to provide application programmers with a method for using least privilege. The principle of least privilege, a B2-level feature, specifies that each process has, and uses, the least powerful level of privilege to perform each action. In standard UNIX systems, the set-user-id principle provides a dangerous form of least privilege. A set-user-id program, such as the **passwd** command, permits users to modify files that would otherwise be protected.

TAPI permits programmers to adjust the privilege level during program execution, so that only those sections of code that require special privileges have those privileges. Although TAPI will provide a finer degree of control over privilege, the set-user-id principle in SVR4 has been enhanced so that it also has a means to turn privilege on or off during portions of a secure program.

File System Comparisons

The Berkeley Fast File System (FFS) is the most popular enhancement made to UNIX file systems, and both OSF/1 and SVR4 will support it. In addition, SVR4 and OSF/1 support a variety of other file system types: System V, the Network File System (NFS), and customer-defined file systems. The SVR4 version is based on Sun Microsystems' "vnode" architecture, while OSF/1 uses the BSD vnodes, an adaptation of Sun's vnodes. Hardware vendors have been adding the FFS and NFS to System V products for years–FFS for its increased performance and NFS for its almost universal acceptance as a networking standard. SVR4 also offers AT&T Remote File Sharing, a proprietary networked file system architecture, and the **/proc** file system, a new development used for process tracing.

For system administrators, it looks like SVR4 has the edge in file system architecture, but OSF/1 has a slight lead here. OSF/1 includes the concept of logical volume management today, which permits a file system to span physical disks, or to be increased *while in use*. Logical volume management is a UNIX feature whose time has come, providing to UNIX systems the type of capability that has been available in MIS environments for years. SVR4 was expected to have a logical volume manager early in 1991.

An important feature of IBM's AIX 3.1, the journaled file system, will not initially appear on either operating system, although both UI and OSF have plans for it. IBM's use of the journaled file system provides both performance and reliability benefits. UI plans to incorporate a journaled file system by the end of 1991, and OSF will leave implementation up to individual vendors.

A new addition to the UNIX system is memory-mapped files. These files permit programmers to treat files as if they were part of a program's data. With older UNIX versions, files are first copied into the kernel's private buffers, then to program data spaces as requested. Memory-mapped files allow a programmer to include the image of a file inside the program's data area. The file is still opened as before, but then is memory mapped and addressed as if it was memory without seeks or reading. The operating system uses its paging system to move portions of the memory-mapped file between the disk and memory as needed. Memory-mapped files offer performance improvements to any disk I/O limited application, and are offered by both OSF/1 and SVR4.

Internationalization Support

Internationalization deals with the problems encountered when moving UNIX

Vendors Slow to Support OSF/1

In a great show of unity, IBM Chairman John Akers, Digital Equipment President Kenneth Olsen, and Hewlett-Packard President John Young stood together with four other corporation heads to announce the formation of the Open Software Foundation in May of 1988. OSF would create a new open systems standard that would seize control of the open systems operating systems market from AT&T and its chosen favorite, Sun Microsystems Inc.

OSF founders feared that Sun, already a successful upstart, would gain an unfair advantage if permitted to participate in the design of the next release, the fourth, of UNIX System V.

Alas, this unity was not to prevail. When the first distribution of the new operating system, OSF/1, was announced, only two former supporters promised to use it to replace their own versions of the UNIX operating system. Only Digital Equipment and France's Groupe Bull actually plan to provide OSF/1 as a replacement for UNIX on their computer systems this year. Other vendors are slower to embrace OSF/1 because it means letting go of their own versions of UNIX and of the applications ported to it.

Tom Chmielewski, Ultrix product manager of DEC, says that the next release of Ultrix, Version 4.1, will be the steppingstone to Version 5.0, the first OSF-based version of Ultrix. DEC plans to be shipping Ultrix 5.0 before the end of 1991. The version shipped on the DECstation 3100 is a developer's kit, an aid in porting software to Ultrix 5.0. Coincidentally, Sun Microsystems is also providing a 4.1 version of its own operating system as a steppingstone to SunOS version 5.0, the SVR4-based product.

Hewlett-Packard, which bought out Apollo, another OSF founding member, says it plans to provide OSF/1 on only one of its four workstation lines–those based on its own RISC architecture. The remaining workstations and minicomputers will continue to use HP-UX, a System V-based variant of UNIX. Jan Silverman, marketing manager for System Software and Communications at HP's Apollo Systems Division, says that HP plans to integrate other OSF modules, such as the Distributed Computing Environment (DCE), into HP's base product line before incorporating the operating system component, OSF/1. It's not surprising, because HP-Apollo gave OSF the DCE technology used as the basis for remote procedure calls.

IBM has been very cagey about letting its OSF-related plans be known. At this point, IBM will say only that it is planning to experiment with OSF/1 on the PS/2, the RS/6000, the IBM 370, and System 390. IBM plans to continue using its System V-based AIX 3.1 on its own line of workstations, the RS/6000, for the time being.

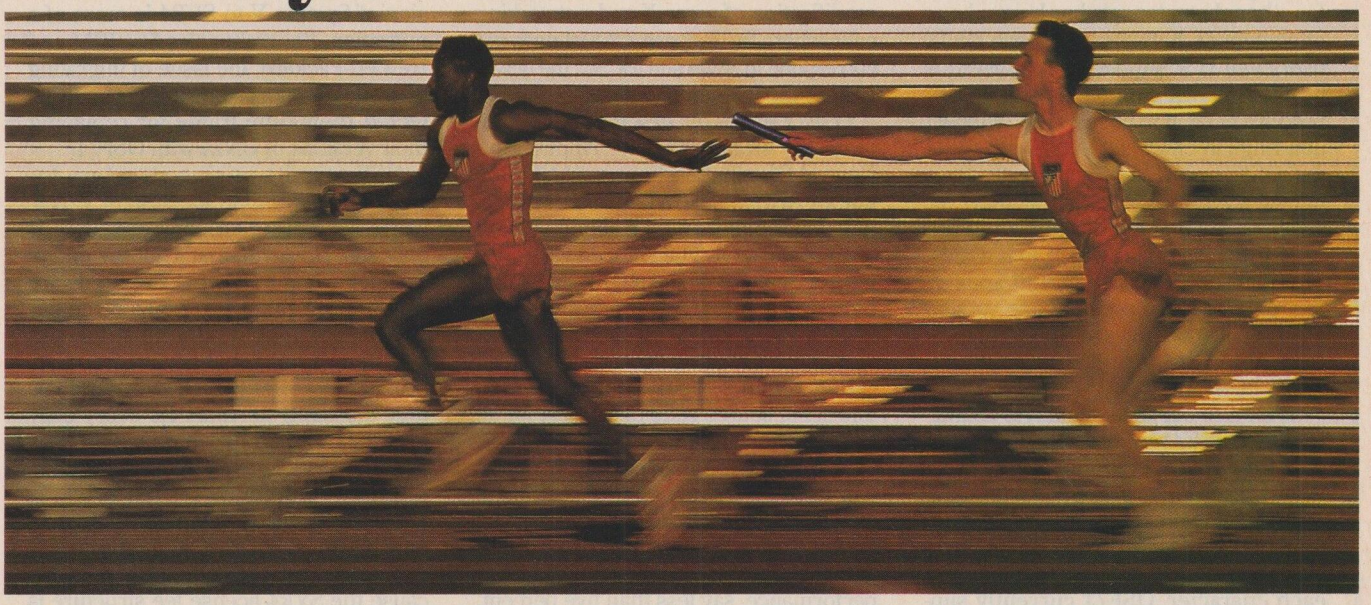
This lukewarm reception of the long-heralded first release is not surprising. OSF/1 represents new, untested technology. Although OSF/1 draws on many other technologies, ask systems integrators what they think about getting many products to work together, and you'll find that the more products involved in the integration, the more troublesome it will be.

OSF vendors must also garner applications that will run on their OSF-supported computers. This is a chicken-and-the-egg problem, because computers cannot be sold without software, and applications won't be ported until the software vendors believe there's a market for their software. What has happened in the past with new hardware must occur again. Hardware vendors must supply OSF/1 on their computers and offer incentives to application vendors interested in porting to their combination.

— R.F.

DBMS Case Study:

Security for the Goodwill Games™*



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The 1990 Goodwill Games: 2500 athletes in 22 events at 15 locations, drawing hundreds of thousands to watch them perform. A show-place for international goodwill. A potential target for terrorists. A challenge for security agencies.

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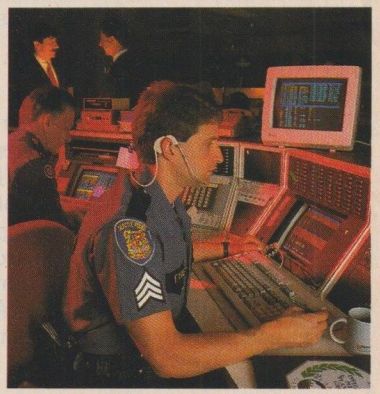

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systems and their applications to environments where the native language is not English. Previously, lack of support for other character sets has been a bone of contention between European UNIX users and U.S. suppliers. To solve this problem, UNIX commands and library routines needed to be revised to support non-English character sets. Both SVR4 and OSF/1 provide commands that recognize a 256-character set, support for different sorting sequences, and message libraries for different languages. The message libraries permit application developers to produce one version of an application that uses different message libraries for presenting the end user's interface.

SVR4 also supports multibyte character sets. OSF/1 works with European character sets, but cannot support Asian languages that use pictographs for characters. A Japanese typesetting system might provide for 20,000 different pictographs, requiring two bytes to represent each character. OSF/1 currently supports only one-byte character sets.

Compatibility Standards: ANDF vs. ABI

Until recently, you could not buy UNIX software for an Intel-based system and expect it to work under SCO UNIX and Interactive Systems' UNIX. Subtle differences made the software incompatible. To solve this problem, some architecture vendors, including Intel, Motorola, Sun, and MIPS, worked with AT&T, SCO, and Interactive Systems to produce application binary interfaces (ABIs) for System V Release 3.2. Software that conforms to an ABI will run without porting on different computers that support the ABI for that processor. This means that an application only needs to be ported once for each CPU architecture, instead of once for each CPU and operating system combination.

At the very least, OSF is to be commended for spurring AT&T into greater concern for user and vendor issues

ABIs lead to "shrink-wrapped" software–software that can run on any machine with the same processor. What's more important, most software that conforms to ABIs for System V Release 3.2 will run on SVR4 without change or recompilation. The majority of existing SCO 386 Release 3.2 software will run without modification on SVR4. Perhaps 10 percent requires modification of some X and networking code where the Release 3.2 ABI does not correspond to SVR4 and iBCS-2, the newer ABI for the Intel architecture.

OSF/1 stakes out new ground in compatibility standards. The Application Neutral Distribution Format (ANDF) is not an ABI. With ANDF, each application vendor ships only a single version of an application. The shipped version is in pseudo-code (the ANDF), and must be converted into native code during the installation process.

ANDF looks like a great idea for application vendors, because there is only one set of source code to support for all OSF/1 platforms. However, the conversion from pseudo-code to native code will introduce some coding inefficiencies, so the translated application will be slower to execute than one delivered in native code. Some small degradation in performance, say less than five percent, would be tolerable to vendors. But with any greater performance loss, the ANDF would be ignored and application programmers would still have to maintain ports to all OSF/1 platforms. OSF has not yet announced an acceptable ANDF technology.

Is OSF/1 All that It Can Be?

OSF was founded to create an operating system product that was not under AT&T's control. Fear of Sun Microsystems' involvement in SVR4 also spurred the creation of OSF. OSF/1 was supposed to be a completely new version of UNIX, free of any involvement of AT&T source code, with a smaller and more efficient kernel.

The OSF/1 kernel still uses code that requires a System V Release 2 or 3 source license. The command set, taken from AIX 3.1, also incorporates code taken from System V Release 2. The new kernel, still named `/vmunix`, will be no smaller than the kernels it replaces--OSF/1 will be about the same size as the Ultrix kernel on a DECstation 3100.

It's not really surprising, because even though the heart of the kernel has been replaced by Mach 2.5, the remainder and the vast majority of the kernel involve the UNIX system and related services, which have not shrunk, but grown even greater. Questions about increased efficiency have yet to be answered, as OSF/1 is still in an early release form and not ready for benchmarking.

Other questions about OSF/1 remain. Vendors who have decided to use OSF/1 must retrain their system programming staffs, support teams, and field engineers to handle a new operating system. While SVR4 vendors will also have some retraining, moving from an earlier version of System V to SVR4 is more of a migration. For companies like IBM and Hewlett-Packard, the issue of migrating their own support staffs has certainly affected their time frame for replacing their versions of UNIX with OSF/1.

OSF says its pricing structure for OSF/1 is lower than for System V. A license for a one-user copy of OSF/1 is only $65. However, that's not the end of the story. It is only what the hardware vendor providing OSF/1 on a computer pays to OSF. The vendor must also pay a System V Release 3 license fee of approximately $100 (which includes a volume discount) to AT&T for every copy of OSF/1. By comparison, a multiuser license for SVR4, using the same volume discount and computer list price, is $126–$39 cheaper than OSF/1. OSF/1 only becomes cheaper when the cost of the computer exceeds $280,000, because the SVR4 license fee structure is based upon the list price of the computer.

Finally, operating system success inevitably comes down to applications. If there are no applications for a computer, only a fool or a programmer would buy it. Application developers will get their first crack at porting to OSF/1, or testing to see if their applications will work without porting, when DEC is supposed to provide OSF/1 for the DECstation 3100 sometime this month. With other vendors holding back, and no ABIs for OSF/1, there are bound to be far fewer applications running on OSF/1 than SVR4 at year's end–thousands less.

At the very least, OSF is to be commended for spurring AT&T into greater concern with user and vendor issues. One of the complaints that helped get OSF started was that AT&T had its own hidden agenda for upgrading its operating system, and that end users had no say in priorities, or even getting needed features.

The founding of UNIX International has brought greater responsiveness from AT&T in making decisions about technologies to incorporate. The entire pace of development has heated up. The end result, for all users, is a much better UNIX operating system. Even though there is no single version of UNIX, we now have two that are closer than ever before. ■

Editor-at-Large Rik Farrow is a software engineer, and author of a book on UNIX system security. He teaches courses on system administration and system security.

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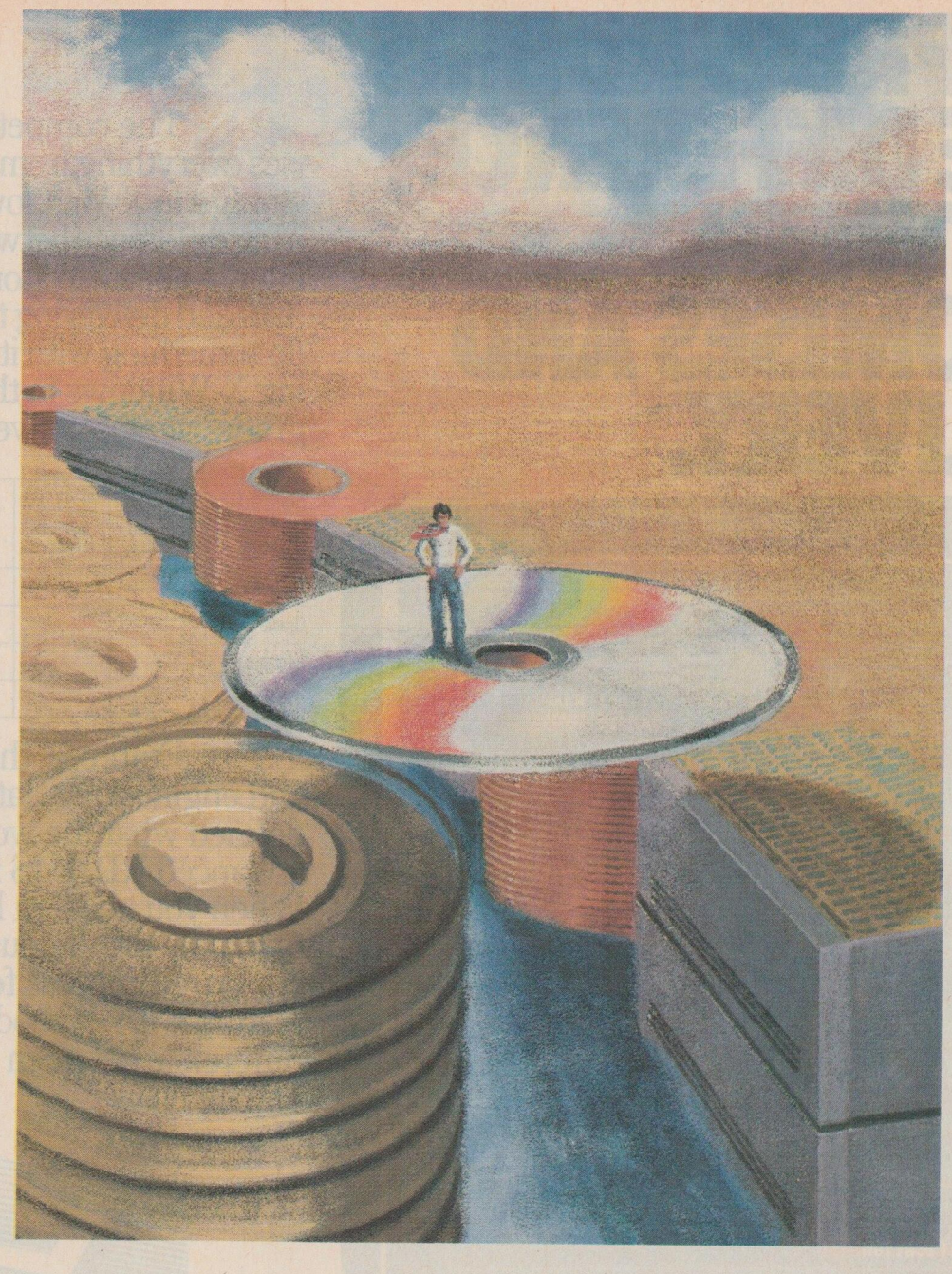

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The Object-Oriented Database Of Your Desire

HENRY HILLIARD

SAIC's George Brown plans to use an object-oriented database for the Air Force's integrated maintenance information system, which will include repair manuals and component catalogs.

Getting past the razzle-dazzle of object-oriented technology to choosing the right database

By Howard Baldwin

George Brown's goal is to fit a United States Air Force jet, its weaponry, instruments, and all its technical documentation into a computer. As an engineering consultant with Science Applications International Corp. (SAIC) in Cambridge, Mass., he's working with the Air Force on its integrated maintenance information system project, using an object-oriented database management system (OODBMS).

The OODBMS will catalog not only the components of the jet, but also the pages of the repair manuals so that a service technician can access the database to fix the plane. Ultimately, Brown and his colleagues will devise a system that will break down the entire airborne weapons system into separate categories, characterizing each component by what it's supposed to do, how it operates, a physical description of it, the parts it contains, and what might go wrong with it.

The information in each of these categories can be delivered either as text, graphics, audio, or video–or any combination of the two. "It's a rich

multimedia model," says Brown, adding that the complexity of the repair procedures can be based on the reading level of the technician doing the work, and that certain repair procedures can come with their own audible warnings and cautions.

Brown's database may sound complicated, but it's not. Just as a relational database is a way to keep track of different data and their relationships, an object-oriented database is a way to keep track of objects and their relationships. As consultant Esther Dyson wrote recently in her Release 1.0 newsletter, "While building an object-oriented database is a complex task, it's not the mystery it may seem. Like artificial intelligence, it leaves you asking, is that all there is?"

Just as the concept of the OODBMS isn't as complicated as it might seem, the purchase criteria for an OODBMS isn't as complicated as it might seem. Before you start though, there's one crucial question–do you really need an OODBMS? No one contends that object-oriented databases will replace relational databases.

Before you even look at an OODBMS, decide what you want to do with object orientation. The OODBMS is currently showing up most frequently in computer-aided design, manufacturing, and engineering (CAD/CAM/CAE) because of the need to keep track of multiple parts and designs. It's also showing up in software development, desktop publishing, and multimedia office automation. Both NCR and Southwestern Bell are using OODBMSs to develop multimedia applications.

If you're a software developer, for instance, the object you want to reuse may be code. If you plan to store images of multiple megabytes, medical records for instance, your object might encompass not only x-ray images but patient histories as well. If you're a publisher, the object may be the masthead, which would include such basic information as text and type size.

Generally, when looking for a software package, you're looking at two aspects: functionality and performance. In the OODBMS world, those two requirements take on different characteristics. Jason Browning, a researcher at AT&T Bell Labs, reviewed a couple of OODBMS products from the CAD standpoint, specifically for the creation of printed circuit boards. Browning created two benchmarks on his own to judge these criteria.

To gauge performance, Browning compared a general-purpose relational database to a database that followed the network structure the OODBMS uses. The question: how long did it take to get information from a text file into the database? "We were looking for ballpark information," explains Browning. "I wasn't looking to see if it was 10 percent faster because the object-oriented database had a lot of advantages in terms of functionality and design. If the performance was in the same general vicinity, but we had that gain in functionality, it was clear that we should go for one of the OODBMSs."

The other test Browning conducted determined how long it would take to access all of the data in the database to get every object from the disk into a working mode in memory. He was looking to find how much space the OODBMS took on the disk and, to a lesser extent, how much space it took in memory. Browning advises this procedure because "the object-oriented databases use roughly twice as much [disk space] as our other CAD databases with a full-finished design." That was acceptable, he notes, because while space was of concern, the time saved was more important.

Selected OODBMS Vendors

Itasca Systems 2850 Metro Dr., Ste. 300, Minneapolis, MN 55425; 612-851-3155
Object Design 1 New England Executive Park, Burlington, MA 01803; 617-270-9797
Objectivity 800 El Camino Real, Menlo Park, CA 94025; 415-688-8000
Ontologic 3 Burlington Woods, Burlington, MA 01803; 617-272-7110
Persistent Data Systems 75 West Chapel Ridge Rd., Pittsburgh, PA 15238; 412-963-1843
Servio Logic 1420 Harbor Bay Pkwy., Ste. 100, Alameda, CA 94501; 415-748-6200
Versant Object Technology 4500 Bohannon Dr., Menlo Park, CA 94025; 415-325-2300

This list contains contact information for those vendors mentioned in this article and is not meant to imply that these are the only vendors offering products in this area.

Taking a Test Drive

Caroline Ross, a software engineer with workstation manufacturer Evans & Sutherland in Salt Lake City, concurs that you should test the OODBMS extensively before buying. One of the reasons Evans & Sutherland chose Gemstone was because Servio had given them so much time to try it out, she explains. Ross had never worked with the Smalltalk programming language before, and she was grateful for the time to learn the technology.

In fact, Ross recommends that kind of prudence to any prospective buyer. "The technology is hard to get into. You've got to plan for a little extra time up front before you can feel comfortable with what you're doing." Ross considers this an important part of the buying decision, disagreeing with the assessment that implementing an OODBMS isn't complicated. "There are still language and tools to consider, and there are rules and syntax just like in any other language. You don't necessary make a good design just by following rules. To create a good design, you need some experience." Ultimately, though, Ross says she is happy with the OODBMS technology and that Evans & Sutherland is committed to it.

Other users concur with Ross on the importance of tools. Jay Ferguson is a senior knowledge engineer at Xerox's Knowledge-Based Systems Competency Center in Rochester, N.Y., working on future unspecified applications that will incorporate both multiprocessing and distributed object-oriented databases. Says Ferguson, "One of our criteria was tight coupling between C++ and the database we'd be using," which turned out to be Ontologic's Ontos.

While Ferguson's group planned to build its own interface tools, they nevertheless found the tools that came with Ontos "extremely useful." His advice: Pay attention not only to the interface, but also the tools you are given for data insertion, removal, storage and testing, especially when it comes to "things that you would have to write if they didn't come with the package, and that would be difficult to implement, even if you were very good at implementing them." Ferguson adds that if the latter was true, you probably wouldn't make the tools as well integrated as the OODBMS developer would.

SAIC's George Brown, who also chose Ontologic's Ontos, agrees. "It's important to be able to do C++ coding," he says, "and not to have to learn any extensions to the language. The class library that supports persistent classes impacts the use of your software. The more useful the class libraries, the better off you are. You're buying a pro-

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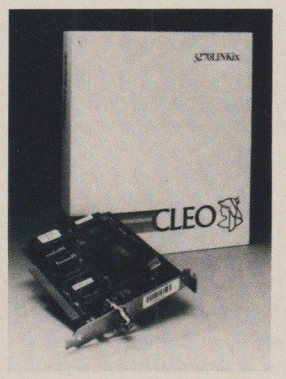

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The 13 Commandments of OODBMS

How do you use an object-oriented database? *The Object-Oriented Database System Manifesto*, devised by a worldwide group of researchers, lists what they think are the commandments.

I. Thou shalt support complex objects
In an object-oriented database, start with simple *objects*: integers, characters, byte strings. Create complex objects by arranging simple objects into lists, groups, or arrays.

II. Thou shalt support object identity
An object can be part of larger objects. With object identity, you're ensuring that when one object is updated in one location, it's properly updated anywhere else in the database that it appears.

III. Thou shalt encapsulate thine objects
Ensures that, as mentioned above, the data in the object is accompanied by code to manipulate the data, and thus are *encapsulated* together.

IV. Thou shalt support types or classes
Objects within the same type or *class* look and behave the same way (with the same *method*, to use OODBMS lingo), but incorporate different data. Objects that belong to a class are referred to as *instances* of the class. You can also create a class solely as a definition, without it having to contain objects. In this circumstance, it's known as an *abstract* class.

The manifesto's authors refer to this as a "touchy" subject because some object-oriented programming languages support the concept of "types," such as ParcPlace Systems' Smalltalk and Servio Logic's Gemstone. Others support the concept of "classes," such as AT&T's C++ and Norway's Simula.

V. Thine classes or types shall inherit from their ancestors
Inheritance allows an object to pass "methods" or behaviors–dictated by code, for example–onto another object without that code having to be amended. The way these behaviors are passed on, and in general the way information is communicated between objects, is via a *message*. *Polymorphism* lets a single message take different forms depending on the object. For example, the "print" message for a spreadsheet would be different from the same command for a CAD drawing.

VI. Thou shalt not bind prematurely
Translation: two different methods can't have been given the same name in two different places in the OODBMS. If this happens, the more specialized method will take priority, accidentally eliminating from consideration objects elsewhere in the database.

VII. Thou shalt be computationally complete
The database will perform anything you can logically expect to ask of it.

VIII. Thou shalt be extensible
Your OODBMS will come with a predefined set of types (or classes), but if it's extensible, you should be able to define new ones.

IX. Thou shalt remember thy data
When a process takes place within an object, the original data should be remembered, or persist. This relates back to object identity, in which the object may be represented in two places.

X. Thou shalt manage very large databases
The OODBMS shouldn't be limited by the size of the computer it's running on. As the manifesto's authors put it, "there should be a clear independence between the logical and physical level of the system."

XI. Thou shalt accept concurrent users
Similarly, the OODBMS shouldn't be limited by the number of users on the system.

XII. Thou shalt recover from hardware and software failures
Procedures in relational databases ensure that the information is as up-to-date as possible in the event of a problem such as electrical failure. They're like internal "save" commands that frequently update the database. An OODBMS should mirror this capability.

XIII. Thou shalt have a simple way of querying data
You should be able to make ad hoc queries to an OODBMS as easily as you can with an RDBMS.

The authors of The Object-Oriented Database System Manifesto *are Malcolm Atkinson of the University of Glasgow, Francois Bancilhon of the French OODBMS developer Altair, David DeWitt of the University of Wisconsin, Klaus Dittrich of the University of Zurich, David Maier of the Oregon Graduate Center, and Stanley Zdonik of Brown University* —H.A.

gramming environment, and if you have a tool that can generate the libraries, you can focus on the modeling yourself rather than the implementation."

Long-range Decisions

Another precaution echoed by several OODBMS buyers relates to the technology in a different way. Simply put, it's new, and the OODBMS companies are fairly new too. Any time you're making a purchase involving a new technology, you have to ask whether the company looks like it has long-range stability.

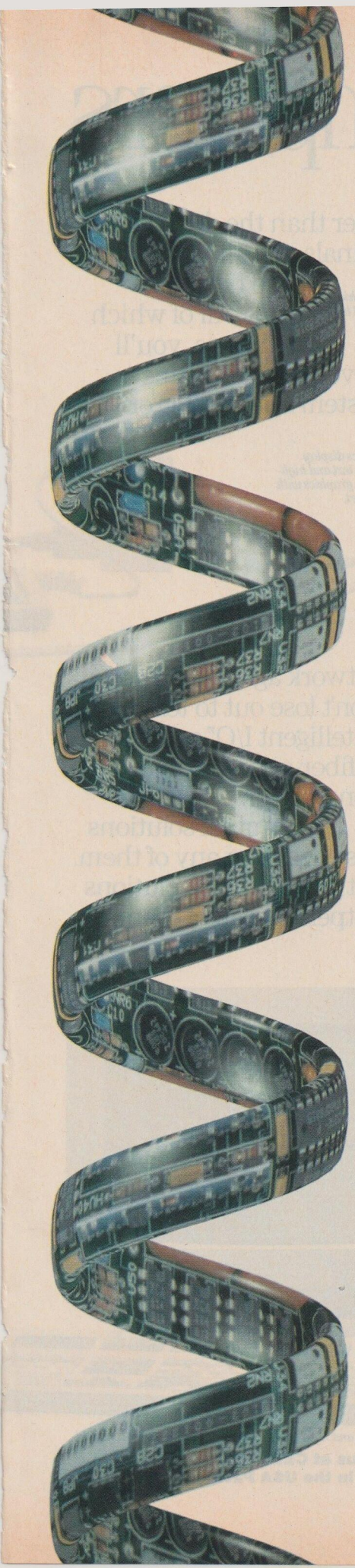
AT&T Bell Lab's Browning went so far as to look into several OODBMS developers' financial reports to see how stable they were. "These are new, small companies," he explains. "You've got to be concerned. [I was also concerned about whether] there was just one guy. If he leaves, is there someone else to take his place? We came to be quite familiar with the two companies we did detailed work with."

When Evans & Sutherland's Ross started evaluating OODBMS, she adapted a list of about 50 questions on how to qualify a relational database. "We put together a questionnaire about five pages long. It asked about disk storage [needs] and recovery techniques. When we got serious, we'd give it to the vendor. It was a lot of questions, but it told us a lot. It showed us where the differences and tradeoffs were [between vendors]."

Telling the Future

AT&T Bell Labs' Browning also quizzed the developers on what kind of evolutionary changes they had for the software, and their plans for improving performance and functionality. In his particular application, dealing with the computer-aided design of printed circuit boards, Browning was especially concerned about the OODBMS developers' plans for compliance with the CAD Framework Initiative (CFI), a standards group of 40 companies devoted to electronic design automation (EDA) standards. (The Object Management Group is looking at object-oriented standards from a wider perspective.)

Beyond the fact that OODBMS software packages represent a new technology, the purchase criteria aren't radically different from any other piece of technology. Ultimately, will it make your company more efficient? Decide whether your job could be made easier with objects, look at how those objects might be structured, and then find software vendors who are willing to set up test databases. Don't be put off by the complexities of a new kind of product. ■



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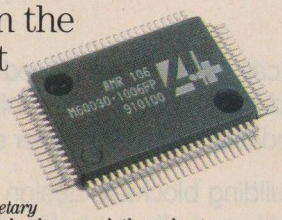

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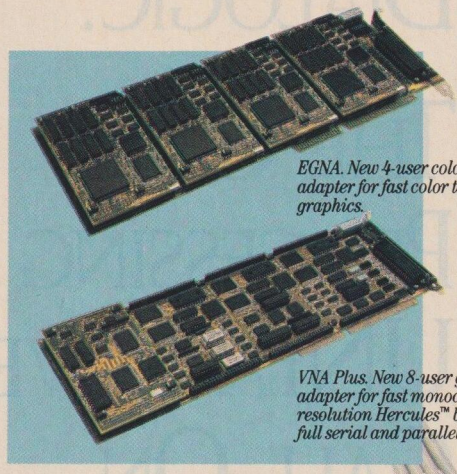

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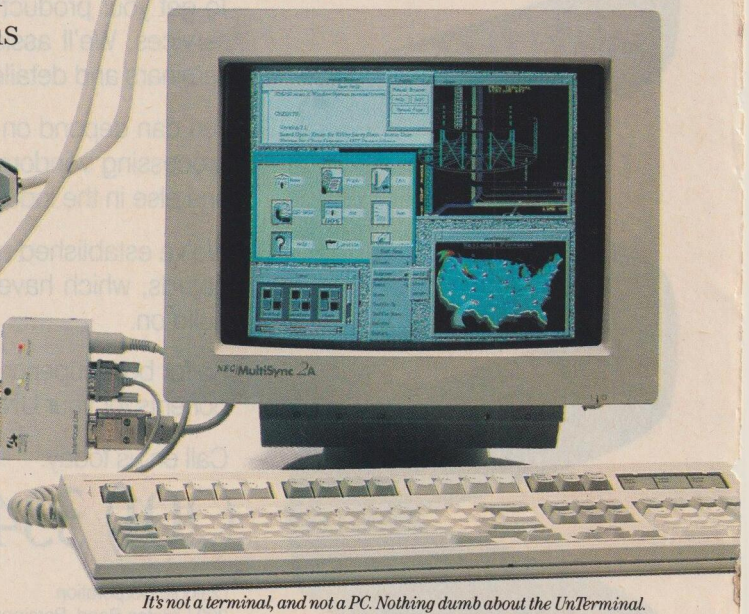

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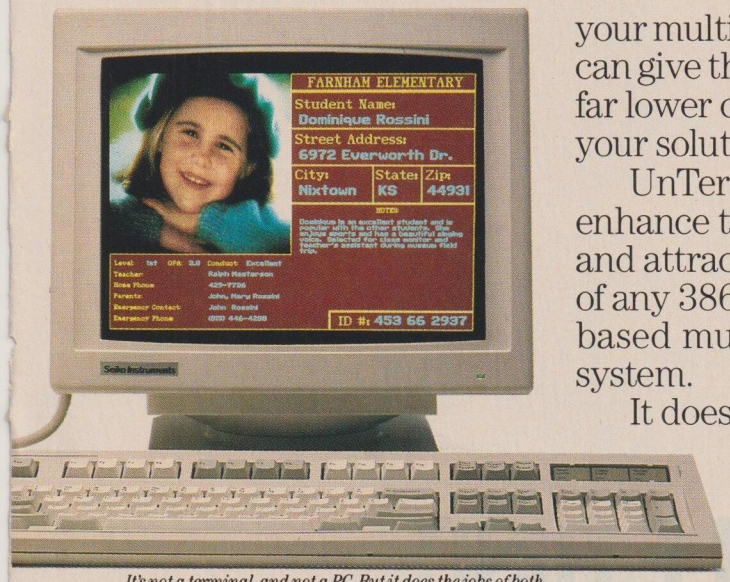

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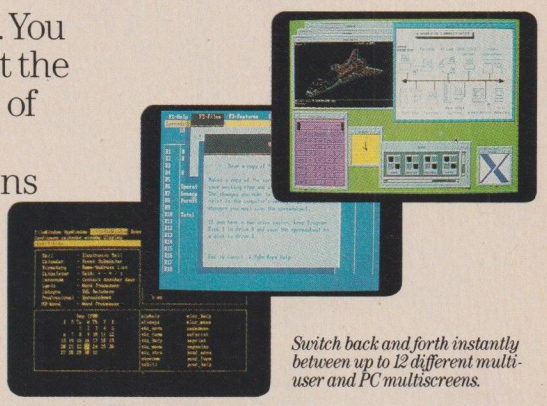

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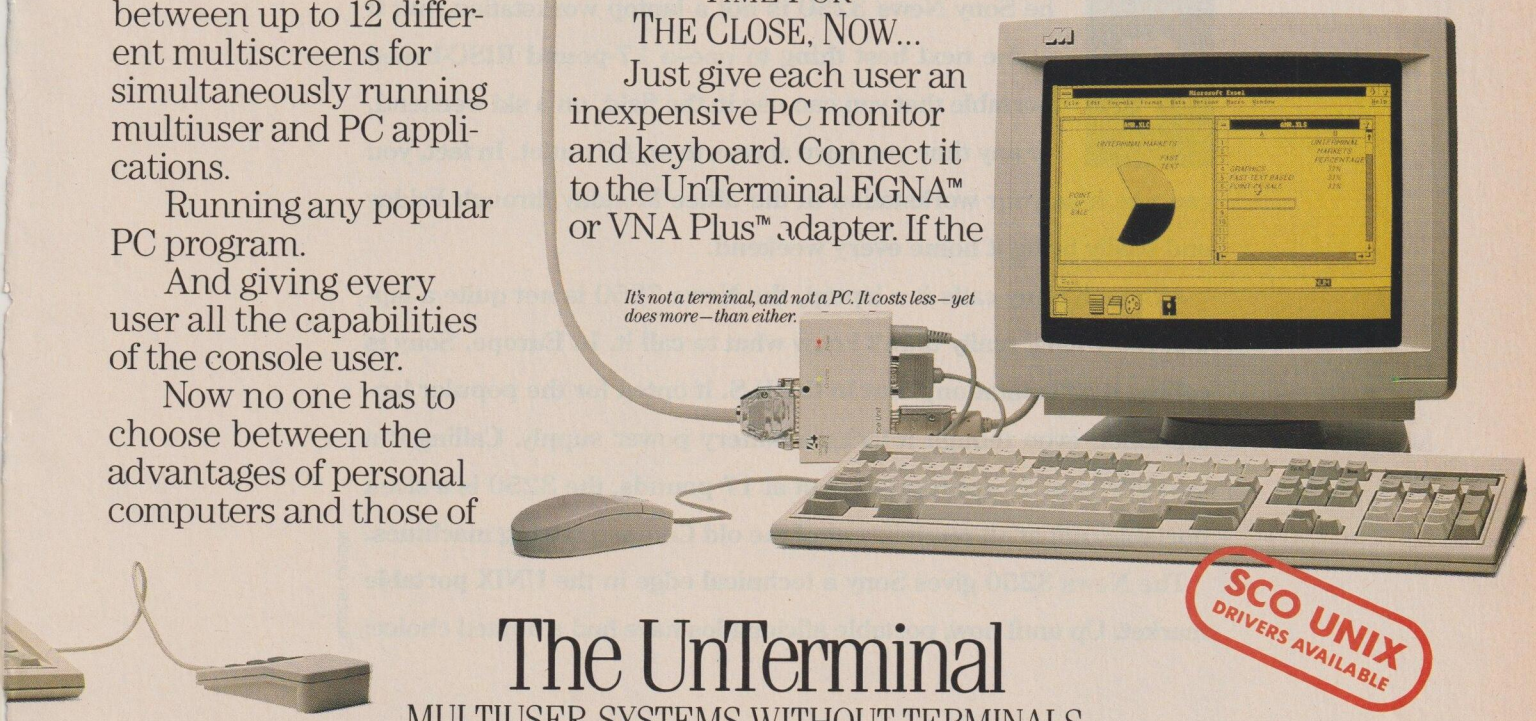

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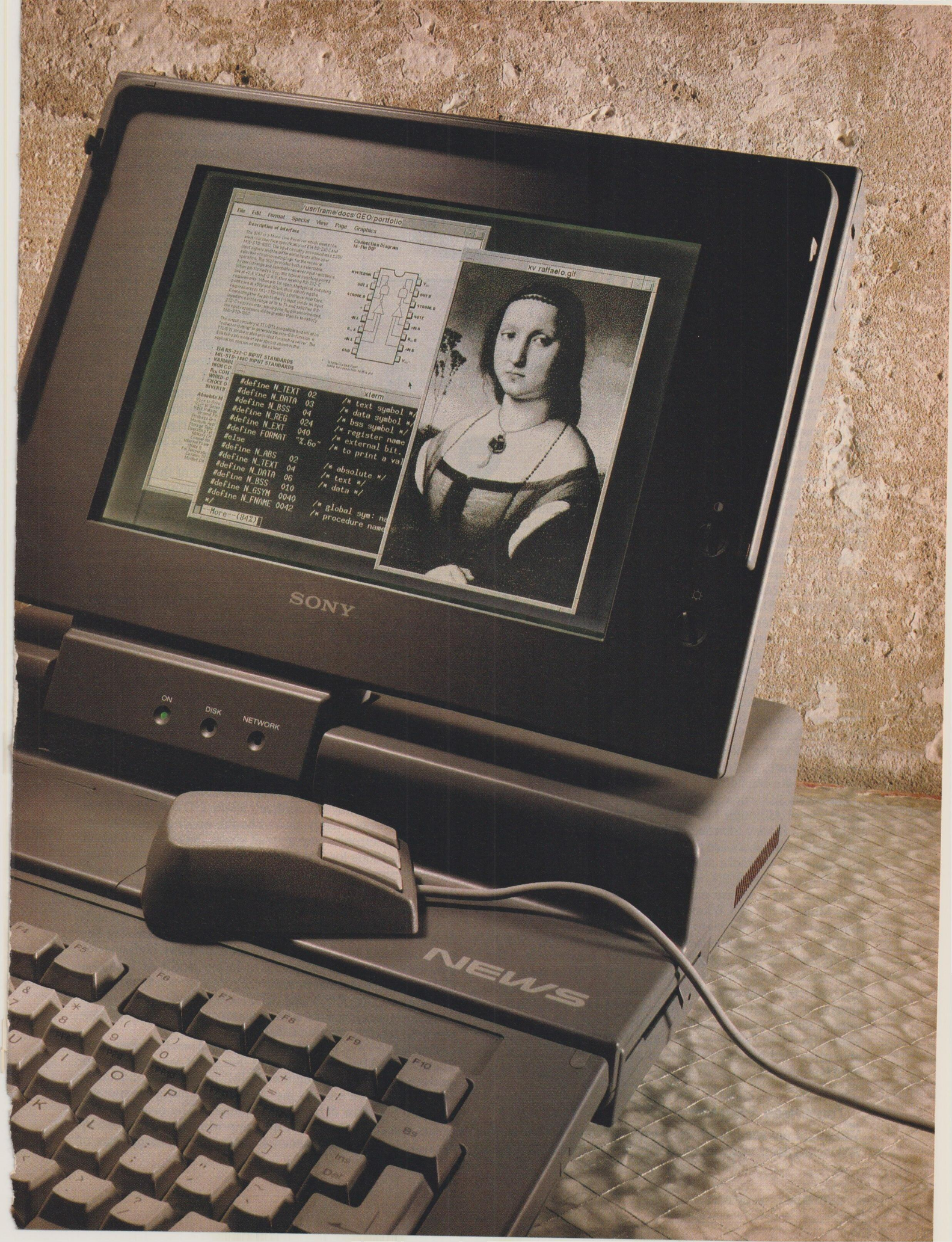
Although Sony calls it a laptop, the News 3250 is not quite a laptop. Sony itself really didn't know what to call it. In Europe, Sony is calling it a "lapstation," but in the U.S. it opted for the popular laptop label, even though it lacks a battery power supply. Calling it a portable is more appropriate, but at 17 pounds, the 3250 is a sleek portable, not at all reminiscent of the old Compaq sewing machines.

The News 3250 gives Sony a technical edge in the UNIX portable market. Up until now, portable aficionados have had a limited choice:

ROBERT CARDIN

By Rik Farrow


/usr/frame/docs/GEO/portfolio
File Edit Format Special View Page Graphics
xterm
#define N_TEXT 02 /* text symbol */
#define N_DATA 03 /* data symbol */
#define N_BSS 04 /* bss symbol */
#define N_REG 024 /* register name
#define N_EXT 040 /* external bit,
#define FORMAT "%.6o" /* to print a val
#else
#define N_ABS 02 /* absolute */
#define N_TEXT 04 /* text */
#define N_DATA 06 /* data */
#define N_BSS 010
#define N_GSYM 0040
#define N_FNAME 0042 /* global sym: na
/ / procedure name
--More--(84%)
xv raffaelo.gif
SONY
ON
DISK
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NEWS

either a 286 or 386 laptop, such as Compaq's 7.5-pound LTE 386s or Toshiba's 3100SX. Toshiba has also developed a RISC-based laptop, but only makes it available in Europe and Japan. The News 3250, which uses the MIPS R3000 17-mip processor, is being manufactured in San Diego, Calif., with full distribution across the U.S.

What distinguishes the News 3250 from 386 laptops is the RISC processor and a high-resolution display. While it is possible to run UNIX on a 386 laptop, running the X Window System in a PC-resolution display (640-by-480) is immensely unpleasant for anyone accustomed to workstations. The News 3250's 1120-by-780 pixel black-and-white display is crisp, clear, and roomy enough for many Motif-bordered windows. Following the cursor can sometimes be difficult, however, so if you intend to use the News 3250 for regular office use, plan on attaching an X terminal. Sony is also working on a graphics card to run 19-inch monitors.

The News 3250 has a SPECmark rating of 11.3. It comes standard with eight megabytes of RAM and 240 megabytes of disk. Built-in Ethernet and SCSI make the Sony equivalent in potential and performance to many non-portable workstations, and at $9,900 for the standard model, the Sony can be used as an economically priced compute server. Besides being the software engineer's weekend companion, this portable UNIX workstation would work well as the sidekick to the salesperson of workstation software, or the contractor performing on-site consulting.

REVIEW HIGHLIGHTS

Sony News 3250
Sony Microsystems Company
645 River Oaks Parkway
San Jose, CA 95134-9890
408-434-6644

+

A high-performance, quiet, truly portable workstation with a crisp and clear display at a reasonable price.

–

Display cannot handle animation or continuously updated graphics because of slow response. Lack of battery power source limits portability.

Price: *$9,900 for base system (8-megabyte RAM, 240-megabyte disk); $11,900 for system with 406-megabyte disk.*
Support: *10 a.m. to 9 p.m. (EST). Monday through Friday, toll-free number. Resellers will provide local support.*
Warranty: *Six months parts and labor.*

The News 3250 runs System V Release 4 for the MIPS RISC architecture. Although MIPS has planned to provide an ABI (Application Binary Interface), other vendors using the R2000 and R3000 processors are pushing to complete the ABI faster to make software more available. Sony already has an OEM port of FrameMaker 2.1, several databases and CAD/CAM packages, and software engineering tools. The News 3250 runs Motif on top of X Windows, meaning most Motif applications can be easily ported to the system.

While not a laptop, the News 3250 is truly portable–easy to set up, use, and pack away again. Its main drawback is in the LCD-display technology that it shares with other laptops, lacking both color and quick-reacting pixels. The pixels change state so slowly that it is easy to lose sight of the cursor. Fast, animated displays are almost invisible. These shortcomings aside, the News 3250 is an excellent workstation at a reasonable price, and heralds even more portable power than standard laptops.

You'll Need A Big Lap ...

You might not want to set the News 3250 on your lap. At 16 3/8 inches deep, and with most of its weight toward the back, it is not a comfortable experience. Also disqualifying it from laptop status is that it does not run on batteries and does not fold into its own case–instead, you put the News 3250 into a case like you would a portable typewriter.

These considerations aside, the News 3250 is a small, durable package, at 3 7/8 inches high by 13 3/4 inches wide, and 16 3/8 inches deep. The display screen covers the keyboard when closed, with slide latches fastening the two together. The keyboard pivots down when the display is tilted up, making the keyboard more comfortable to use. The keyboard is full-sized, with a light, comfortable touch, but no numeric keypad. The mouse, a three-button mechanical model, connects at the right side of the keyboard, but the cord is long enough for left-handed users.

Along the left edge of the keyboard are jacks for stereo input and output. Sony has placed great emphasis on its multimedia capabilities, and includes almost CD-quality sound in all of its workstations. Also on the left side, hidden in a hole, is a reset switch that can only be pressed by using a pointed tool. Hiding the reset switch is a good idea, especially on a portable.

Across the back panel are the other I/O connectors, including a thick Ethernet connector and a SCSI connector. The News 3250 uses two SCSI addresses internally, leaving six addresses for externally connected devices. A Centronics parallel port uses a non-standard connector, and a single serial port uses the common DB-9 connector. The serial port has a maximum baud rate of 19,200.

The News 3250 has a single expansion slot designed for I/O boards that use Sony's proprietary 50-pin I/O bus. The 3-by-5-inch slot accepts a piggy-backed board, making it possible to fit a lot of electronics into a small space. Sony has published the specifications for this board and says other vendors have started designing accessories. Sony is also developing a 9600 baud modem for this slot. (For the time being, you have to use an external modem, a drawback in portability.)

The right side of the system case has a slot for a 3.5-inch floppy drive. Sony provides some 13 different floppy disk formats, including four MS-DOS formats, and its own high-density, 2-megabyte format. I was able to format and `tar` files to a diskette and read them on a Sun SPARCstation 1, boding well for compatibility. The floppy drive's eject function runs under software control (see the `eject` command). A tool is also provided for forcibly ejecting a diskette.

One feature that I found intriguing was a small, sliding panel above the keyboard. By opening this panel, you expose connectors for up to four additional SIMMs (memory modules), and a switch that permits the Sony to boot using the monitor or serial port (for debugging terminals). The panel lets you easily install SIMMs, but I question whether it is too easily accessible. The 3250 comes standard with 8 megabytes of

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CIRCLE NO. 178 ON INQUIRY CARD

memory, in two 4-megabyte SIMMs. Total memory capacity is 36 megabytes. Sony sells a 4-megabyte SIMM for about $600.

Inside, you will find the News 3250 packed, but not cluttered. A bracket across the back holds both the switching power supply and a 3.5-inch hard disk. A 240-megabyte hard disk is standard with the 3250, which leaves about 60 megabytes of user space after loading UNIX and providing swap space. A model with a 406-megabyte drive sells for $2,000 more, which would be worth it for serious software developers using the 3250. The SCSI drive was somewhat faster than many of the workstations I have reviewed, but slower than the RS/6000, with its journaled file system. A small, quiet fan draws air across the power supply and out the left side. The fan is important, because the R3000 CPU dissipates a lot of heat. The floppy drive rests in its own bracket in front of the hard disk.

The system board, approximately 12-by-11 inches, uses surface mount technology. Many of the chips on the board are made by Sony, something unusual in most workstations, including several ASICs for I/O and system support. The 20-MHz MIPS R3000, a higher performance, binary-compatible version of the R2000, sits alongside the R3010 math processor. In the MIPS architecture, the compiler attempts to provide work for both the R3000 and R3010, so that processing can go on in parallel, without waiting for floating-point operations to complete. There are 64 kilobytes of no-wait-state cache on the board, an average-sized cache for a workstation of this caliber.

Now Hear This

You can see several Sony chips toward the front of the PC board. These chips handle the digital-to-analog (D/A) and analog-to-digital (A/D) conversions necessary for recording and playing back sound. This Sony can sample as fast as 37.8 kilohertz from each of two channels for stereo sound. The sound quality comes close to compact discs, and follows the CD-ROM XA standard for recording digital sound. Slower sampling rates are also available, permitting applications such as voice mail, which requires less of a frequency range than music and uses less disk space to record messages because of its sampling rate of 8 kilohertz.

There is a small speaker under the keyboard, which by itself is insufficient for quality sound. However, the output jack permits you to connect the Sony to speaker systems like the ones used to add speakers to Walkman portable recorders. Sony has plans to integrate sound into its version of FrameMaker so that you could hear a recorded comment or example sound as part of a document. Sony's sound files are compatible with sound files for the Next computer, but Next's Digital Signal Processor is more sophisticated than the D/A and A/D in the 3250.

You can easily read the backlit LCD display screen from angles up to 45 degrees away from the screen, making this a clear and clean display. The screen is about 11 inches on the diagonal (approximately 9-by-6 1/4 inches), which is large for a laptop, but small compared to workstations. Because this is an LCD screen, there are no electromagnetic emissions from the screen.

Also unlike CRTs, which redraw the screen 60 times a second, the LCD displays in general are much slower to draw and erase. On a monitor-based workstation, no matter how fast you move the mouse, you can easily follow the cursor as it moves around the screen. But on the News 3250, the mouse disappears unless you move it slowly. I got around this by running the **xeyes** demo (which has a pair of eyes that follow the cursor). After I had used the Sony for a while, I became accustomed to the mouse, and could more easily find it and use it without the visible feedback I was used to having. Other demos that involve movement, such as the icosohedron demo (`ico`), which bounces about the screen, were difficult to see.

For static display of text and graphics, the display was excellent, with good performance for drawing text and graphics. But for dynamic displays, you'll need a real monitor and video board, something not currently available for the News 3250.

Some Software

Sony has chosen to use System V Release 4, which combines many Sun and Berkeley features with System V Release 3. As a user you can expect to find most of the utilities and functionality that you are accustomed to finding in either variant of UNIX. Unfortunately, MIPS Computer Systems has yet to complete the ABI for SVR4 and the R2000/R3000 processor family. If the ABI is defined, any software conforming to the ABI will run on any conforming platform, which should make software more available for the Sony, and other workstations using the MIPS chips.

Sony's decision to support Motif means that many of the burgeoning number of Motif applications will eventually run on the News 3250. Sony also has its own OEM port of FrameMaker 2.1, and there are several CAD/CAM packages, graphics and architecture design, and office automation software already available for this system, even though it is newly announced. The C compiler, X, and Motif come standard. Pascal and Fortran are optionally available.

The News 3250 is a versatile workstation. It can be connected to a network, and used with NFS, RFS, or TCP/IP-based software off-the-shelf. With its SPECmark of 11.3, 17 mips and 1.8 double-precision megaflop performance and under $10,000 price, the Sony could be used as a compute server, and its portable nature overlooked. The Sony cannot touch the RS/6000, because of its floating-point performance, but the Sony provides a much better deal for the same entry price.

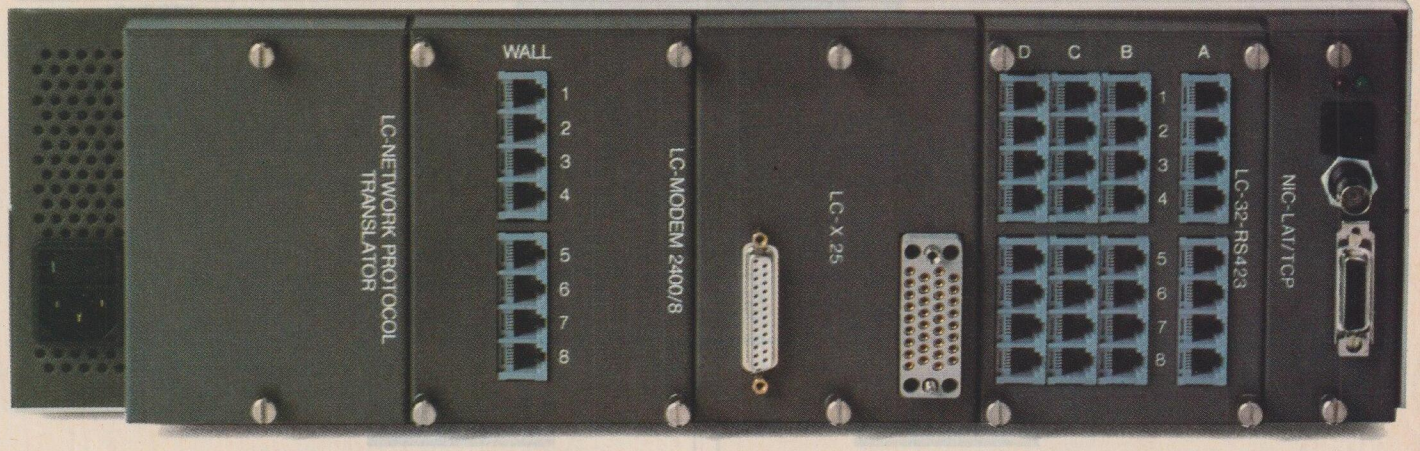
As for support, Sony offers a varied set of plans in addition to its six-month warranty on parts and labor. The support plans and annual fees are standard software service ($720), software update service ($540), on-site hardware service ($852), carry-in repair ($600), and hardware diagnostics ($432). Sony also offers consulting services, as well as non-plan coverage, at an hourly rate of $135. Sony offers its support out of San Jose, Calif.

Toshiba announced its own "laptop" portable, a SPARC-based system in May 1990. The Toshiba portable weighs about the same, has a 1152-by-900 pixel display, and similar I/O capabilities. The Toshiba also lacks a battery power source. At present, the Toshiba is only available in Japan and Europe, and costs $14,000 for somewhat less performance (a SPECmark of 10). In terms of UNIX experience in the U.S. market, Toshiba trails Sony, which has marketed a modestly successful line of workstations in the U.S. for two years.

All in all, the News 3250 is great for anyone who wants to carry their computing with them. Because the Sony uses X Windows, hooking up to an X terminal gives you a means of making it a part of your normal work environment. On the other hand, you can pack it for the road in a minute or two. Just remember, the News 3250 is not a laptop. It is a portable and lightweight one at that. It promises to develop a following amongst weekend programmers, salespeople, and others who travel. ■

Rik Farrow is a software engineer, and author of a book on UNIX system security. He teaches courses on system administration and system security.

Five Easy Pieces.



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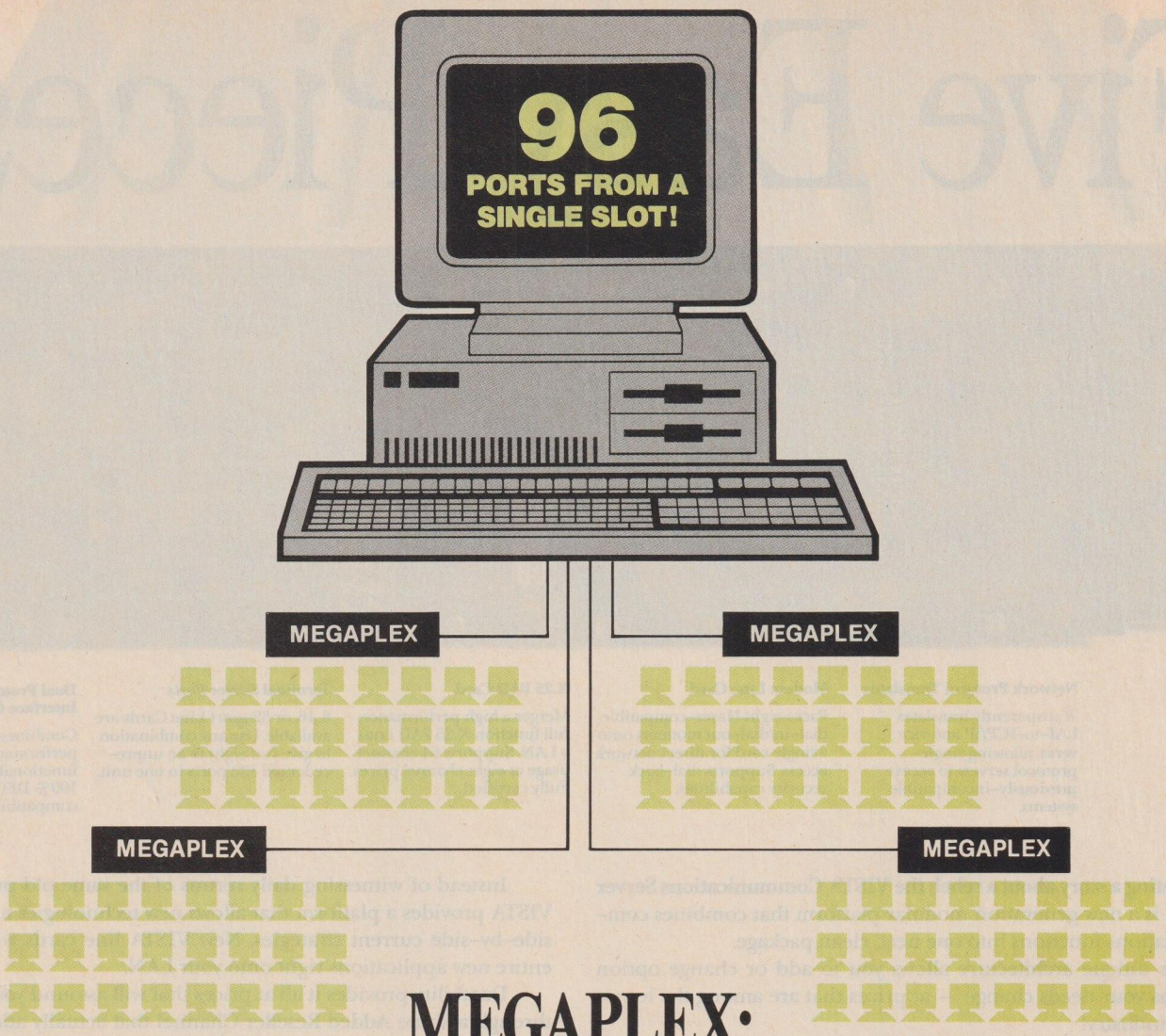

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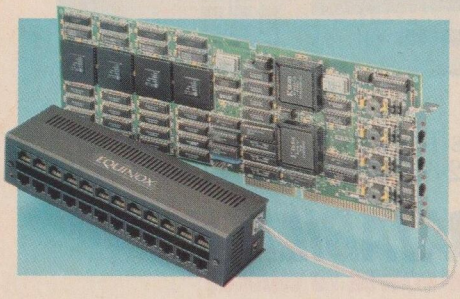

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CIRCLE NO. 210 ON INQUIRY CARD

FAST TRACK TO MOTIF APPLICATIONS

By Steven Mikes

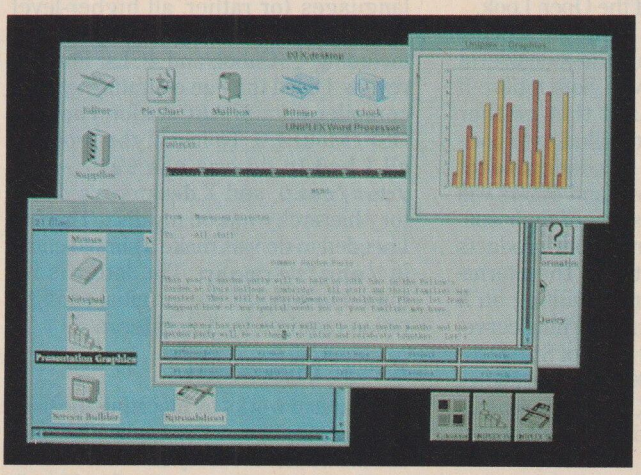
X.deskterm and SoftOption are fast and easy routes to creating X applications

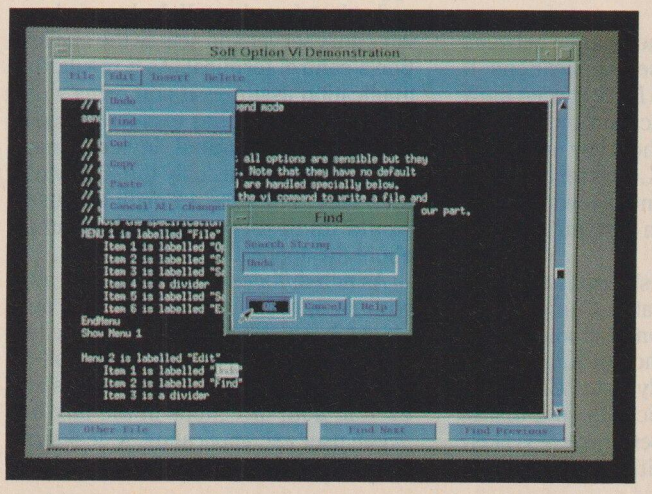
Two new programming kits to emerge in the X Window System arena–X.deskterm, from IXI Limited, and SoftOption, from Cambridge Connectivity–put a different slant on X development by letting you convert existing character-based applications into X applications. We took a look at both products and found them effective, so long as you can survive rough documentation and some evolving vendor relationships.

Both products are healthy signs for X. In addition to converting character-based applications, these toolkits from Cambridge, England (both vendors are located there), also give Motif developers a fast way to build UNIX host-applications that connect to Microsoft Windows in DOS. To this end, IXI and Cambridge Connectivity have joined with JSB (also in England) to create a Microsoft Windows version of X.deskterm that runs with JSB's Multiview X emulator. With the JSB product, applications run on the UNIX host, but look and feel like any other Microsoft Windows application.

These GUI (graphical user interface) translators, to coin a phrase, have their roots in IXI's development of its popular X.desktop manager. IXI initially built X.deskterm for its own use, then licensed the technology to Uniplex under the name of **uterm**. Uniplex used **uterm** to translate its office automation software into X. As is necessary with X.deskterm, Uniplex modified its source code in order to redirect output to **uterm** (which is still X.deskterm's name for its executable). Other notable development efforts with X.deskterm include projects by Bank of America, General Electric, and Eastman-Stewert in England. Altered Image of Surrey, England, has also used X.deskterm and SoftOption to create a 3-D graphics package that runs with Informix under Motif.

In 1990, IXI ported X.deskterm to OSF/Motif and decided to sell it on the





As GUI translators, X.deskterm and SoftOption allow character-based applications to be converted into X applications. X.deskterm (top) can equip such applications with Motif widgets or gadgets. SoftOption (bottom) provides the tools to create unrestricted Motif interfaces, including the ability to create a WYSIWYG front end to a character-based word processor.

open market. At this point, Cambridge Connectivity licensed the technology and developed SoftOption. The attraction of SoftOption is that you do not have to modify your source code, as Uniplex did. Instead, you build an executable version of the SoftOption translation. This sits between the user and the character-based application. The user sees a scrollbar representing a color spectrum, but the application knows nothing about the scrollbar–only a range of numbers defining colors.

X.deskterm and SoftOption are alone in the field of GUI translators. GUI-builder products such as UIM/X, from Visual Edge, and Guide, from Sun Microsystems (see UNIXWORLD, January 1991), are competitors in concept, but not in approach. Both UIM/X and Guide, as well as a dozen other GUI builders on the market, provide WYSIWYG tools to accelerate the GUI process, as well as produce X-coded applications. The Extensible Virtual Toolkit, a GUI programmer's library from XVT Software (Boulder, Colo.), is also a conceptual competitor, because it supports Microsoft Windows as well as Motif, Macintosh, Presentation Manager, and two versions of the Open Look.

SoftOption works through X.deskterm, so this review looks at X.deskterm first and concludes with SoftOption. It should be emphasized that neither product is a permanent solution to porting to X. In the long run, independent software vendors (ISVs) and others will demand native X versions of their software. In the short term, both products are quick ways to port to X. The alternative, as I have seen in consulting on X topics, is a 6- to 18-month learning curve. And, at the combined price of $1,500 for 386 platforms or $3,000 for workstations, X.deskterm and SoftOption are reasonably priced for run-time development environments.

X By X.deskterm

X.deskterm is the messenger between X and character-based applications. It picks up and delivers I/O between the X server and the application's user interface, and does so without any noticeable performance hit. X.deskterm's only weakness is it does not allow programmers much latitude in customizing interface objects.

In one sense, X.deskterm is an intelligent terminal emulator. Compared to running an application in an **xterm** window, the performance of X.deskterm applications is slightly faster. Compared to rewriting an application so it makes native calls to X, the performance is likely a little slower. In either case, performance depends on current system loads and available memory for swapping. Personally, I found performance acceptable.

X.deskterm comes in the form of a pre-linked application (C libraries are optional) and works alongside existing character-based applications. Its role is to act as the I/O liaison between the user and the application. X.deskterm has expanded terminal functionality to include windowing and mouse functions specific to X. The primary means of communication between X.deskterm, the application, and X is via escape sequences.

With X.deskterm, existing character-based applications can be equipped with a Motif widget or gadget, including scrollbars, push buttons, icons, scrolled lists, and menus. Additional areas of support include colors, fonts, mouse interface, pop-up dialogs, and the X Windows inter-client communications conventions. In short, X.deskterm provides the tools that commercial applications require. Only when you want to create custom objects–ones allowable within a particular styleguide, but not foreseen–does X.deskterm reach its limitations.

X.deskterm supports all higher-level languages (or rather, all higher-level languages support escape sequences), including C, Cobol, and 4GLs. For this review, I used the Sun operating system compiler on a SPARCstation running OSF/Motif 1.0. To install the product, all I had to do was use **tar -xvf /dev/rst0**, and X.deskterm's directory hierarchy was on my disk. Then all I needed to do was make a simple entry in **/etc/termcap**. The latter is required to support the terminal configuration required by X.deskterm.

Escape from ASCII

X.deskterm works by inserting the user interface between the application and the user. In an ordinary character-based application that uses stdin (keyboard) and stdout (monitor), X.deskterm simulates an X server and acts as the application's control terminal. As a result, the application assumes it still owns stdin and stdout–that it has exclusive access to a physical terminal device. Meanwhile, the user sees only the X or Motif interface. I'm sure an ordinary user would think there was nothing un-X about the application.

As noted, X.deskterm communicates with an application through stdin and stdout, but it also uses something called the X.deskterm Protocol, a series of escape sequences. Escape sequences are used in both directions in the link between user and application. X.deskterm uses the notions of *downward* and *upward* to describe the link. Downward describes communications from the application to X.deskterm. Upward describes communications from X.deskterm to the application.

The downward link supports commands implemented as escape sequences. These are the escape character (ASCII 27) followed by an arbitrary sequence of characters used to provide control information. Characters ranging from ASCII 128 to 159 provide line drawing and shading commands. Of the remaining characters, some are used for simple functions and the rest are ignored. The typical way to insert an escape sequence in C source code is in a **printf** statement.

The upward link operates in one of two modes: responseless or responsive. In responseless mode, characters are

REVIEW HIGHLIGHTS

X.deskterm
IXI, Limited
62-74 Burleigh St.
Cambridge, England CB1 1OJ
+44-223-462131

Easy to get applications working in X, reduces development time, expert assistance from IXI in porting applications, reasonably priced for run-time development environment.

Documentation needs much improvement, licensing agreements between IXI and Cambridge Connectivity need refinement, limit to customized objects not prescribed by Motif.

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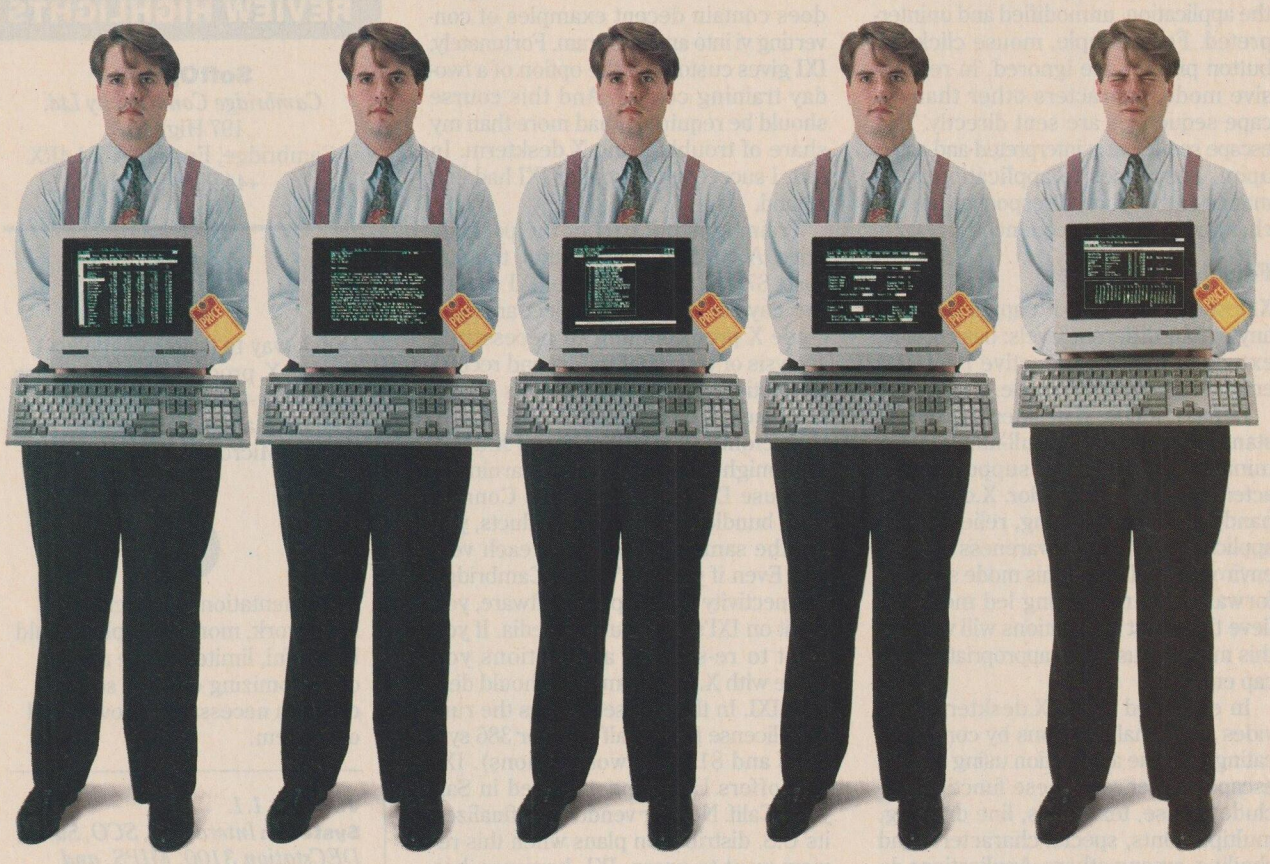

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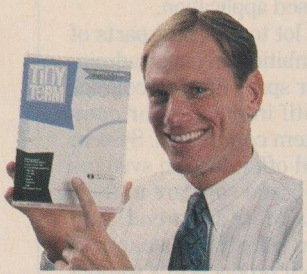

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passed through X.deskterm directly to the application, unmodified and uninterpreted. For example, mouse clicks or button presses are ignored. In responsive mode, characters other than escape sequences are sent directly. The escape sequence is interpreted and acted upon. Responses to application commands and keyboard responses are exchanged as escape sequences.

Four Modes to Use

X.deskterm works with applications in any of four different levels: basic mode, extended mode, interactive mode, or enhanced interactive mode.

In basic mode, X.deskterm provides standard features of a full-function terminal, such as cursor support, character attributes, and color. X.deskterm handles window resizing, relieving the application from any awareness of the X environment. I found this mode straightforward, and my testing led me to believe that most applications will work in this mode by using an appropriate termcap entry.

In extended mode X.deskterm provides additional functions by communicating with the application using special escape sequences. These functions include mouse, text fields, line drawing, multiple fonts, special characters, and shading, among others. Applications do require some modification, but the necessary escape sequence–such as `\e,50,75,150,75` to display a scrollbar on the left side of the screen–is usually painless, although tedious.

In interactive mode, X.deskterm fully supports the mouse and clipboard for smooth interaction with other X Windows programs. Applications normally require minor modifications to the keyboard handling code to support this mode. From a programming viewpoint, this calls for some brain power, but only as much as needed to define user responses and boundary conditions–and then to enter them in your stdin code.

Finally, in enhanced interactive mode, X.deskterm delivers the full capabilities of the X Windows environment to the application, including pop-up menus, scrollbars, dialogs, and other objects. In this mode, X.deskterm fully supports interaction with the X.desktop by using X inter-client message protocols. This permits the new application to support the creation of icons on the user's desktop. It also lets you execute other programs and gain access to X.desktop's built-in utilities.

Training Required

As its stands today, X.deskterm cannot be self-taught. The documentation leaves a lot to be desired, although it does contain decent examples of converting vi into an X program. Fortunately, IXI gives customers the option of a two-day training course. And this course should be required. I had more than my share of trouble using X.deskterm. In fact, I succeeded only after IXI had lent a hand.

Training is not part of the package price. According to X.desktop, training costs $7,000. For this price, IXI spends two days at your site. Subject areas include X programming (if necessary), analysis of your application, and recommendations and demonstrations of how to connect X.deskterm to it.

Deciding how to purchase X.deskterm might take longer than learning it. Because IXI and Cambridge Connectivity bundle each other's products, you get the same package from each vendor. Even if you don't need Cambridge Connectivity's SoftOption software, you get it on IXI's distribution media. If you want to re-sell the applications you make with X.deskterm, you should deal with IXI. In these cases, it cuts the runtime license fee in half ($99 for 386 systems and $195 for workstations). IXI also offers U.S. support based in San Jose, Calif. Neither vendor had finalized its U.S. distribution plans when this review went to press. IXI, however, has used Unipress (Edison, N.J.) to distribute X.desktop.

In retrospect, X.deskterm is a difficult product to evaluate. Because of the variable nature of applications, unknown language bindings, and unknown end-user environments, it is not possible to develop the traditional kinds of documentation usually associated with application development tools. You must already have an application in mind, or at least a clear idea of how you want to use it, in order to properly evaluate its usefulness to your organization.

Unless you are already familiar with the features available to exploit in Motif or other X environments, you may have difficulty in understanding the potential benefits of X.deskterm. Good advice would be to investigate X.deskterm. It offers the fastest means to integrate your existing applications into the X environment.

SoftOption

SoftOption adds another layer to X.deskterm and its message passing to the X server. In the SoftOption layer are the tools to create unrestricted Motif interfaces, including something as exotic as giving a character-based word processor a WYSIWYG front end. Best of all, you don't need the source code to convert the character-based application.

This means a lot to different parts of the industry. Ambitious system administrators (in their spare time, of course) could build Motif interfaces for commonly used system commands. System integrators could offer custom systems using character-based software as their basis, but with a Motif front end. And developers, from self-styled hackers to ISVs, can port their products to X without even touching the original source code.

Not only does SoftOption broaden the audience for GUI translators, it may just be the shot in the arm X needs. Envision a DP/MIS shop that wants to convert to X, but can't abandon its existing character-based programs. A team of programmers armed with SoftOption could solve this dilemma in a few months by creating X front ends on all

REVIEW HIGHLIGHTS

SoftOption
Cambridge Connectivity Ltd.
197 High St.
Cambridge, England CB4 4RX
+44-0954-51920

Quick way to translate applications to X, product installation was easy, easy-to-use English-like scripting language, potential path to Microsoft Windows.

Documentation and packaging need work, more examples would be useful, limited in the area of customizing objects, some concern necessary for overhead on system.

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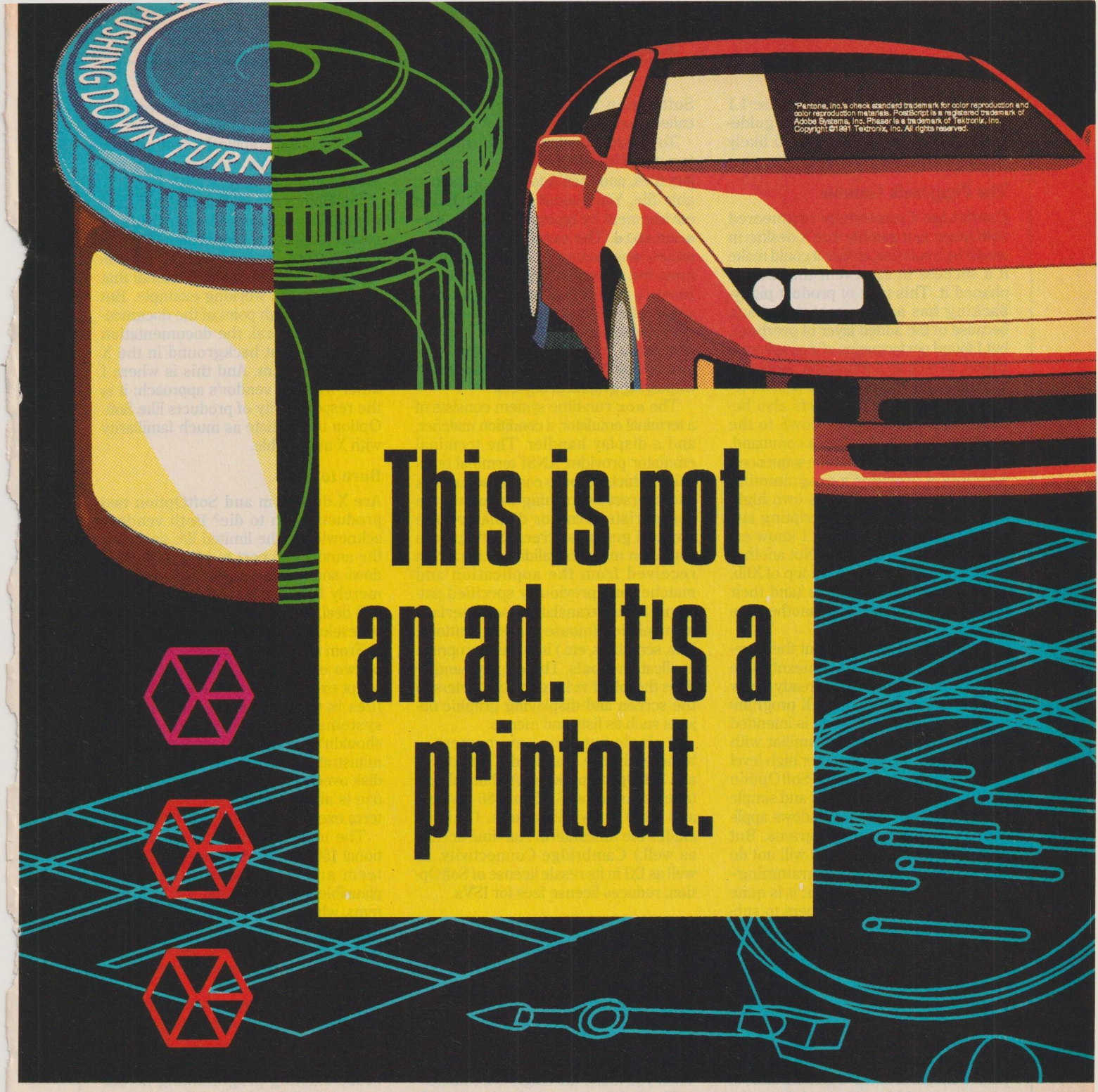

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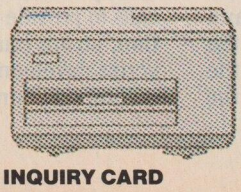

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applications. And, because Release 1.1 of OSF/Motif has better style guidelines, the DP/MIS team would likely create reasonable interfaces.

The Piggyback Gamble

Cambridge Connectivity engineered SoftOption in a gamble that X.deskterm would be a success, or that it could make it a success in the event that IXI orphaned it. This type of product piggybacking has an inherent drawback because of the added layer of overhead, but I found performance of example programs, as well as a translated version of vi, to fall well within the two-second response frame. Motif objects also behaved impeccably, right down to the single push button for the `:s` command.

Instead of using raw escape sequences, SoftOption provides a programming interface, complete with its own high-level language binding, scripting language, and compiler. Now, I know exactly what you're thinking: Not another programming language! On top of Xlib, Xt, and Motif function calls (and their thousands of parameters), another programming language?

This is what I thought. But then I realized SoftOption was not meant to be used by developers who already know (or are learning) the other X programming interfaces. SoftOption is intended for programmers already familiar with 4GLs, Cobol, Fortran, or other high-level languages. In this regard, SoftOption lives up to its objective: a fast and simple means of developing X Windows applications from existing programs. But like X.deskterm, SoftOption will not do any elaborate custom programming–which is not all that bad, but it is quite often necessary for developers to subclass a new custom widget in almost any GUI toolkit.

For testing purposes I ran SoftOption on top of my existing X.deskterm on the SPARCstation. I used `tar` to install the software, which organized itself on disk. As for documentation, I was disappointed in the plastic-bound manuals and disjointed sheets of notes–a general table of contents would have helped. I got the feeling Cambridge Connectivity was overestimating its audience's tolerance.

The Intermediate Module

SoftOption, like X.deskterm, produces a module that acts as an intermediary between the existing character-based application and the user. This intermediary module is actually terminal emulation software that intercepts and interprets the *conversation* between the user and application. It then hands the result of the conversation over to the SoftOption run-time environment, called `sor`.

To program the intermediate module, you compile SoftOption scripts into object files, and then into a single executable file. You execute the SoftOption environment by typing `sor -s executable`. The executable file determines what action to take depending upon the direction of the conversation (user-to-application or application-to-user). I found that it appropriately converted user interface actions into the text input expected by my test programs. SoftOption was also unflawed in displaying graphical objects.

The `sor` run-time system consists of a terminal emulator, a condition matcher, and a display handler. The terminal emulator provides ANSI terminal emulation, which decodes control sequences and characters, turning them into the appropriate form for display on the physical graphics screen. SoftOption's condition matcher validates characters received from the application and matches any previously specified patterns. It also translates user interface manipulation (mouse clicks on buttons, lists, scrollbars, etc.) into the appropriate application inputs. The display handler does the job of writing the characters to the screen and displaying graphic objects such as lists and menus.

A single run-time environment is bundled in the standard X.deskterm and SoftOption package. Additional run-time licenses cost $195 for 386 systems and $390 for workstations. (This includes the X.deskterm run-time license as well.) Cambridge Connectivity, as well as IXI in its resale license of SoftOption, reduces license fees for ISVs.

Steps to X

Developing a SoftOption interface for an application requires skills common to writing any other type of compiled program. First, you must manually code the source statements into a file. Then you use the SoftOption compiler to produce an object file (or listing of errors). Then you make the single executable.

The SoftOption scripting language is quite detailed; it is, in fact, as powerful as most any shell or compiled language. It supports comments, case sensitivity, variables, identifiers, constants, declarations, expressions, arguments, conditional execution and flow control logic, and functions.

The SoftOption Runtime Intrinsics library includes more than 170 function calls to provide screen image manipulation, string handling, display output, script development routines, and miscellaneous functions for simple file handling and other system-related functions. The intrinsics include support for handling color, graphical screen objects, scrollbars, buttons, menu handling, and event handling.

SoftOption comes bundled with programming examples that include source scripts for Cambridge Connectivity's Motif version of `vi`. The documentation includes a short tutorial that uses `vi` as the working example. But this was the high point of the documentation. In general, the documentation lacks sufficient background in the X Window System. And this is where I differ with the vendor's approach: it is the responsibility of products like SoftOption to incubate as much familiarity with X as possible.

Born to Die?

Are X.deskterm and SoftOption two products born to die? Both vendors acknowledge the limited life span, but the announced port to Microsoft Windows sounds like a healthy future. IXI merely licenses its technology in the JSB deal, while Cambridge Connectivity is developing a new product.

From a user's viewpoint, the addition of two executables–the runtime and script executables–to existing program files is no burden. On 386 and 486 systems, where disk space is (but shouldn't be) an issue, some system administrators might look askance at the disk overhead. The total additional disk use is about 1 megabyte (the X.deskterm executable itself is 900 kilobytes).

The memory overhead of an additional 150 to 200 kilobytes (with X.deskterm and SoftOption running) is plausible, if not desirable. On DOS systems, where memory and disk space is tighter, users might be more skeptical of the overhead involved, but they need not be since the application executes on the UNIX host.

SoftOption is easy enough to use and effective for quickly converting character-based applications into X applications. The product is a good way to reuse existing programming investments. And, for the time being, if not longer, SoftOption, like X.deskterm, should be considered a cost-effective alternative to re-engineering character-based applications for X and Motif. ■

Steven Mikes is an author of UNIX and X programming books, and is also an active consultant to several Fortune 500 companies, specializing in UNIX, X Window System, Microsoft Windows, and PC applications development.

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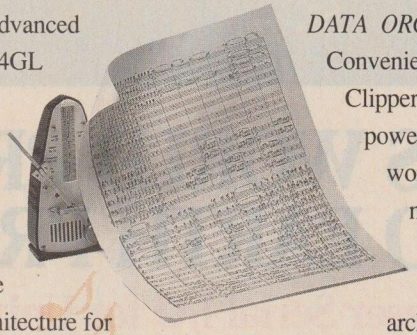

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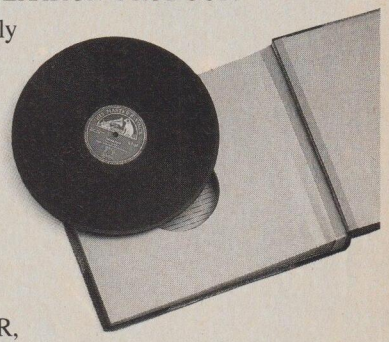

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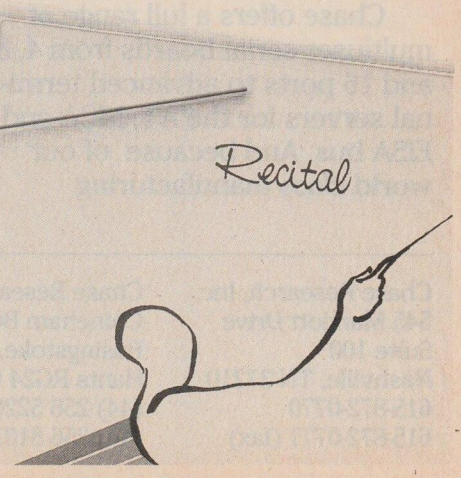

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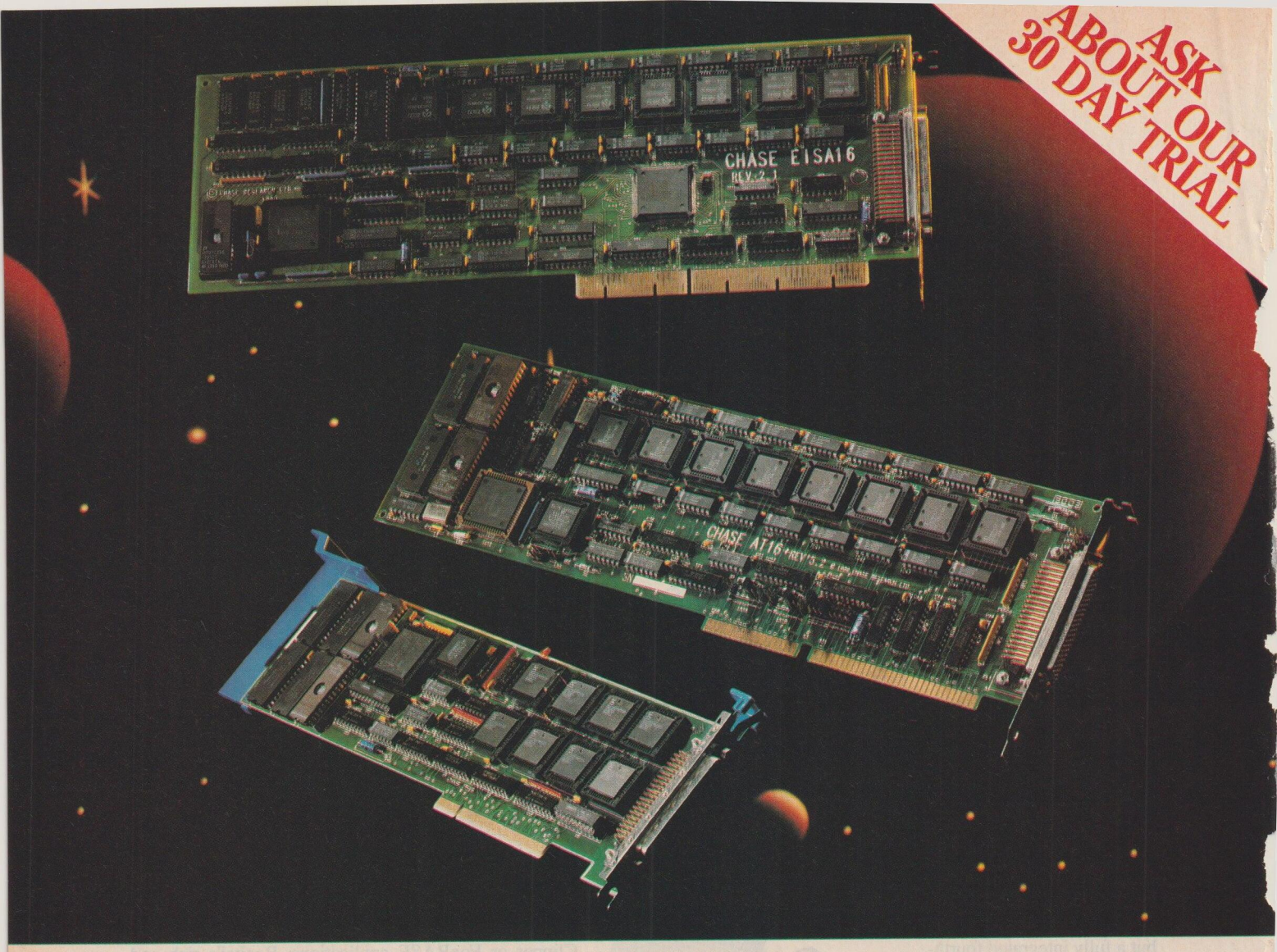

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CIRCLE NO. 222 ON INQUIRY CARD

EITHER SYNCHRONIZE OR CLOCKWISE

By Rick Farris

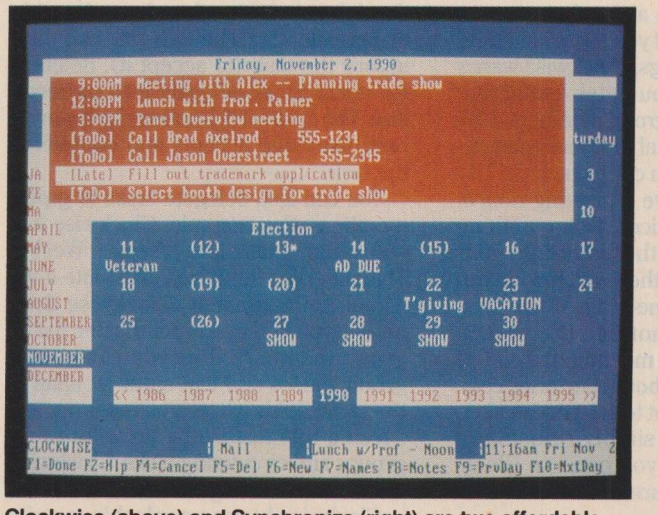
These time and task managers help organize individuals and groups

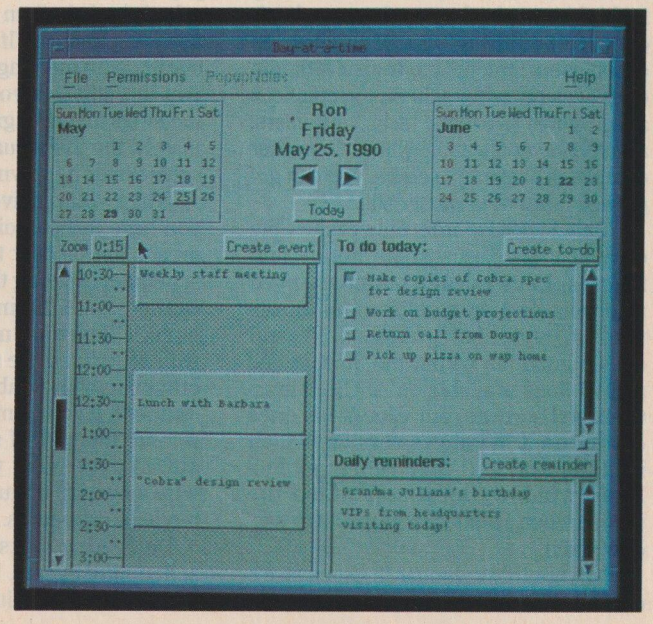
Is UNIX ready for software programs that pop-up *to do lists*, schedule meetings, and assign tasks to co-workers? The appearance of Clockwise from PhaseII Software and Synchronize from Crosswind Technologies suggests so. Both products are affordable ways to learn whether computers can better organize the day-to-day affairs of groups of people.

The big stumbling block for products like Clockwise and Synchronize is that these products depend on a group commitment to be used successfully. And sometimes, no matter how much managers might encourage using personal and group productivity software, workers balk at it. Even so, businesses are clamoring for group software, or *groupware*, and DOS and Apple vendors have been responding with a flurry of products.

Clockwise and Synchronize are solid UNIX entries. Neither is subject to the criticism of some DOS groupware, meaning that they are not simply repackaged calendaring programs with e-mail features. At the same time, neither has addressed the broad range of workgroup issues, as has AT&T's forward-thinking Rhapsody, which integrates sales, inventory, and travel expenses, among other things, with appointment tracking, meeting scheduling, and task assignment. Rhapsody, however, requires a major committment by a business (with hardware, it sells for up to $95,000 and uses NewWave under DOS as the user interface).

Groupware is not a new concept in UNIX. Office automation software such as Uniplex and Alyce offer scheduling tools that work with e-mail, providing the base-level tools of groupware. What's new about Clockwise and Synchronize is they bring groupware to sites that use general-purpose business applications, but don't ascribe to the office automation software. Of the two, Synchronize integrates well with other applications because of its Motif interface while





Clockwise (above) and Synchronize (right) are two affordable examples of group productivity software for UNIX. You can use the products not only to organize your worklife, but to coordinate meetings and projects with others in your workgroup.

Clockwise relies on standard ASCII file transfers.

The main purpose of both Synchronize and Clockwise is to make groups work in harmony. If you carry an appointment book or make heavy use of a desk calendar, you'll like these products. They organize appointments and meetings, store telephone numbers and addresses, manage to-do lists, coordinate your life with others in the group, and (in Clockwise) even report signs of the zodiac and phases of the moon. Neither product requires UNIX skills, although Synchronize assumes that you're accustomed to using the X Window System.

I tested Synchronize and Clockwise on a 386 system running SCO Open Desktop. Synchronize was tested under Motif and Clockwise was run in a text mode. Each installation took about 10 minutes and went flawlessly, although neither took advantage of SCO's `custom` installation program. Clockwise was flexible and allowed me to install it in a subdirectory of my choice. Synchronize was more stringent about where I installed its files, but it is more flexible on a system with symbolic links.

Clockwise: Powerful Features

You need not belong to a group to use Clockwise from PhaseII Software. Most of its tools serve equally well for individuals. But several, quite powerful features are tailored to groups, including event scheduling, personnel tracking, task delegation, and group security.

Clockwise supplies a calendar, appointment book, name and address book, to-do list, and other scheduling tools. It extends the appointment book concept by letting you add events to other users' calendars. It also lets you check calendars for scheduling conflicts; attach notes to events, tasks, and users; and receive notification when a co-worker completes a task. If need be, you can get printed reports of most data.

The Clockwise interface makes life easy. It uses Lotus style menus and function keys to run commonly used routines. And on a color monitor, options are stylishly highlighted. PhaseII does a good job within the 80 columns and 24 lines available on ASCII character-based screens, but Clockwise cries out for an X Windows version, which is in the works. (I tried running it in a Motif window, but it scrambled the screen when I made adjustments to window size.)

The monthly calendar is Clockwise's control center. It first appears as a relatively unadorned grid, but as you enter notes, tasks and events, the software annotates them with legend symbols. The symbols are ASCII characters such as asterisks and exclamation points. The display gets somewhat hieroglyphic in nature, so I opted to use the sliding bar to display lists of activities associated with a given day. You can also use this method on months and years.

Clockwise lets you override the calendar interface through its main menu, which has Schedule, View, User, Print, and Default options. The menus use the Lotus slash command paradigm. In addition, major options such as scheduling events and deleting tasks are accessible through the F1 to F10 keys. For some commands, control key sequences are used as well. All keyboard definitions are tied to a particular screen, meaning you can use the menus until you know the keys.

Most commands in Clockwise lead to pop-up windows that display listings or prompt for data. For example, the *event* pop-up includes an entry area for attendees and resources, such as overhead projectors and meeting rooms. Many of the pop-ups let you *tag* items in order to specify criteria. After exploring this feature, I found that I particularly liked the ability to tag *repeating* events by day, week, or month. This means if you have a staff meeting every Monday, you only need to enter it once a year.

A Group Effort

I enjoyed the event scheduler. When scheduling an event, you must first enter attendee names into the master scheduling form. Before doing this, you will want to press F6 (or its equivalent) to pop up a window listing each attendee's schedule. It is then a simple matter to peruse schedules. If you try to schedule overlapping meetings, Clockwise warns you but still lets you enter conflicting meetings for other group members. Ultimately, the individual member must resolve his or her own conflicts.

When you receive a meeting notice, you have three choices. Doing nothing means you accept the event into your schedule. Deleting the event means you cannot make the meeting. If this happens, Clockwise notifies the person who scheduled the meeting. It also lets other users know about your prior commitment. If you want to suggest an alternative, instead of simply refusing to attend a meeting, you can use Clockwise's overlay feature to view other attendees' schedules.

Delegating tasks works similarly to scheduling events. When you delegate a task, Clockwise immediately informs the delegate by posting the task to his or her calendar. The delegate can then ignore the task (to accept it), delete it (to reject it), or delegate it to someone else. The chain of delegation can continue until someone accepts and completes the task.

You can also delegate tasks to group members. For example, Clockwise lets you assign a task like "Prepare Weekly Status Report" and then distribute it via e-mail. Unfortunately, Clockwise does not let you select from a master list of group members. But you can create group aliases and can enter an alias in the same fields where you enter names. I tested this feature by creating three groups and circulating tasks. Clockwise didn't miss an assignment.

Clockwise has some valuable security features. It handles access to your schedule by letting you assign one of three security classes to each of the other

REVIEW HIGHLIGHTS

Clockwise
PhaseII Software Corp.
444 Washington St.
Woburn, MA 01801
617-937-0256 800-735-2557
`uunet!psc3bb!clockwise`

To-dos are pushed ahead automatically, group schedules are checked for conflicts, nice PostScript output, excellent handling of resources like conference rooms.

Output on non-PostScript printers is rough, databases aren't well integrated, no network support internal to product.

Version: *1.1.*
Systems: *SCO UNIX, Interactive 386/ix, AT&T UNIX V/386, AT&T 3B2, DECstation 2100 and 3100, Sun-4.*
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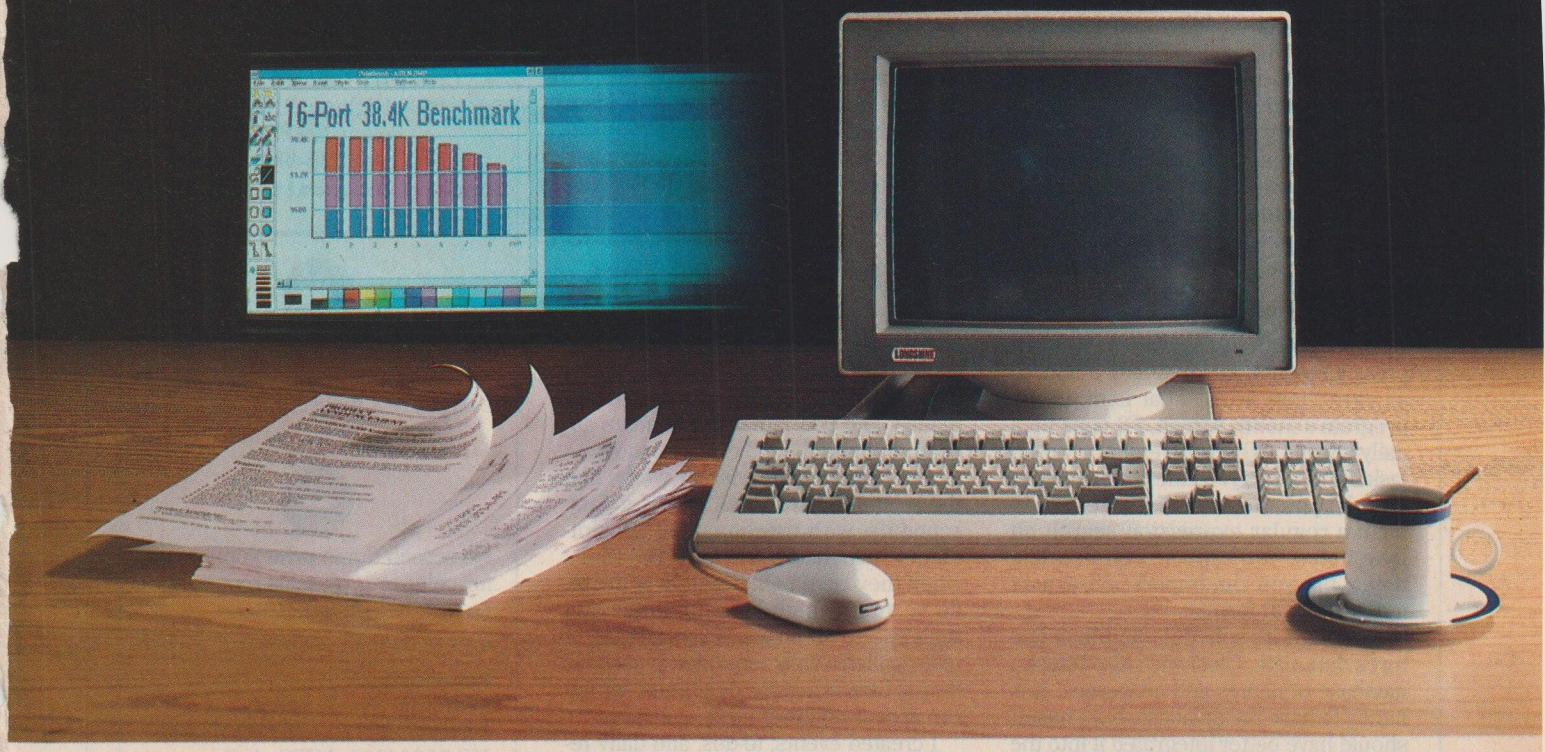

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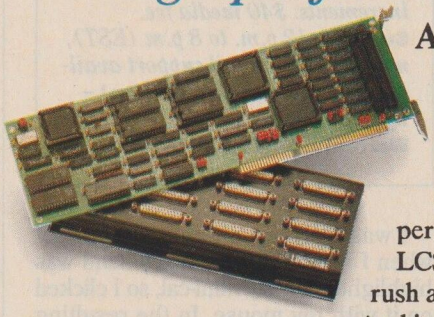

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CIRCLE NO. 200 ON INQUIRY CARD

Clockwise users. The default security, *append*, lets other users check your schedule for availability and schedule new events for you, but does not allow them to see details about individual items on your schedule. A more stringent security level, *check*, lets them check your schedule, but prevents them from adding appointments. The *full* permission level lets other users access and modify your schedule as if they were you.

Make Note of This

At most points in Clockwise, you can press a function key to attach a note to an event, task or calendar item. In the program's month screen, F8 pops up a daily journal. When you enter or view a task, F8 also lets you enter a note. Other keys let you time stamp a note or perform a regular expression search on long notes. You can't search multiple notes, but you can import and export notes in ASCII format.

Although its schedule and task features dominate, Clockwise also offers a database of names and addresses. It is handy to have the database, but PhaseII should have better integrated it into the product. As it stands, they are no more useful than your pocket address book–sufficient for looking up a name, but restricted because you can't copy names into forms. I can think of one useful application for this: copying e-mail addresses into schedules.

PhaseII had to make some tough decisions about which printers to support. Unlike WordPerfect, which ships hundreds of printer drivers with its product, Clockwise chose to support two basic types: PostScript printers and everything else. When printing to a PostScript printer, Clockwise's daily, weekly, and monthly printouts look like they rolled off a desktop publishing system. But the output from other printers looks rudimentary. PhaseII says it will support HP laser printers in its next release.

All in all, Clockwise is a well-made product. I tried to outsmart it several times, such as when I delegated a task to my boss, who had previously delegated it to me. Clockwise caught me in the act. This type of user anticipation, as well as the overall interface design, is a convincing display of groupware engineering.

X-based Synchronize

I wanted Synchronize the first time I saw it. Its calendar window was snuggled between the clock and the calculator on the right hand side of the X display. It begged to be explored.

Synchronize was built for X and Motif from the ground up. It is not a quick conversion of an ASCII product, but a true X product. Synchronize has fewer organizational features than Clockwise, such as no task delegation, but it's a swift scheduler. And at $500 for a five-user license, and $100 for each user thereafter, it is more affordable than Clockwise.

Synchronize's calendar window is its doorway into a rich set of groupware tools. When I clicked on a date in the calendar, the Day-at-a-time window appeared. Here I could schedule events, reminders, and to-dos. I could see other users' schedules with a click of my mouse, and two monthly calendars appeared across the top of the window.

The Day-at-a-time window works like the calendar. On the left side is a daily schedule, with meetings and appointments "penciled" in next to the times when they occur. On the right is the to-do section, which lists the items and their check- off boxes. A special kind of to-do, called a daily reminder, is used for items, like schedule deadlines, which can appear on other users' calendars.

I created events, to-dos, and daily reminders by clicking on buttons for each type of event. Events, to-dos, and reminders can have pop-up notes attached to them. Attendees of a meeting can see the notes that others have attached to the meeting, and can attach their own notes or add comments to the existing notes.

Synchronize makes good use of the X environment by popping up a fill-in form, which I liked because I could still see my other work. I wished I could use the X clipboard to paste data from other windows, but CrossWind says it decided to forgo the clipboard in version 1, the reviewed product. It said it had scheduled it for version 1.1, which should be available now according to Crosswind's development timetable.

A Network of Peers

Synchronize users can reside anywhere on your network, but you need to select some common location for the database of events, to-dos, and reminders. If users don't wish to log into the machine with the Synchronize database, they need to access it using NFS or RFS.

Synchronize has a nifty way of scheduling group meetings. As I selected attendees from a check-list, their busy times were blanked out on my weekly calendar. After I clicked on each attendee, the calendar clearly showed times when all attendees were available.

REVIEW HIGHLIGHTS

Synchronize
Crosswind Technologies, Inc.
6630 Highway 9, Ste. 201
Felton, CA 95018
408-335-4988
`uunet!xwind.com!synchronize`

Intuitive interface made possible by solid X-integration. Multiday events are supported.

No screen dump print support for color or gray-scale monitors, no task delegation.

Version: *1.0.2*
Systems: *Sun-3, Sun-4, DECstation 3100, HP 9000/300, HP 9000/800, MIPS, Aviion, SGI, Pyramid, SCO Open Desktop.*
Licensing: *Per user.*
Price: *$100 per user, sold in 5-user increments. $40 media fee.*
Support: *12 p.m. to 8 p.m (EST), non-toll-free. E-mail support available via* `uunet!xwind.com!-synchronize`.
Warranty: *90 days on software.*

I was working on another project when I noticed that January 22nd was highlighted on my mini-cal, so I clicked on it with my mouse. In the resulting Day-at-a-time window I saw that my secretary had scheduled a meeting for me. At the bottom of my calendar were yes, no, and maybe buttons; I clicked on the yes button to show that I would attend. Synchronize uses this information to list whether attendees have committed to the meeting.

Synchronize doesn't notify you when someone declines to attend your meeting. In fact, Synchronize takes a decidedly passive role in most areas. For example, you can schedule meetings, but in order to learn whether someone has declined to attend, you must open a window and look. To its credit, Synchronize does automatically carry forward to-dos.

Security is a simple matter in Synchronize. All users can check your

schedule to see if you're available for a meeting. You can give permission for specific users to open your Day-at-a-time window and see the details of your schedule. If you wish, you can even give permission to modify your schedule.

Resources such as conference rooms and overhead projectors are treated just like users in Synchronize. The only difference is that resources can be modified by any user in the group. One particularly dislikeable aspect about Synchronize is each resource requires a license, so you have to pay $100 for each projector and conference room in your organization.

Synchronize uses an X facility called **xwd** (X window dump) and **xpr** (X printer) for printouts. Because of limitations in the standard X utilities, I couldn't get any printouts on my laser printer. According to CrossWind, color and gray-scale monitors do not support X window dumps. Version 1.1, which was scheduled to be released in January 1991, will support PostScript printers directly, bypassing the troublesome **xwd** and **xpr**.

Which to Buy

It is not difficult to recommend both Clockwise and Synchronize. If you have run a character-based system, choose Clockwise. It is comfortable in traditional offices with a hierarchy of executives, managers, and workers. It works on low-cost ASCII terminals and supports multilevel task delegation.

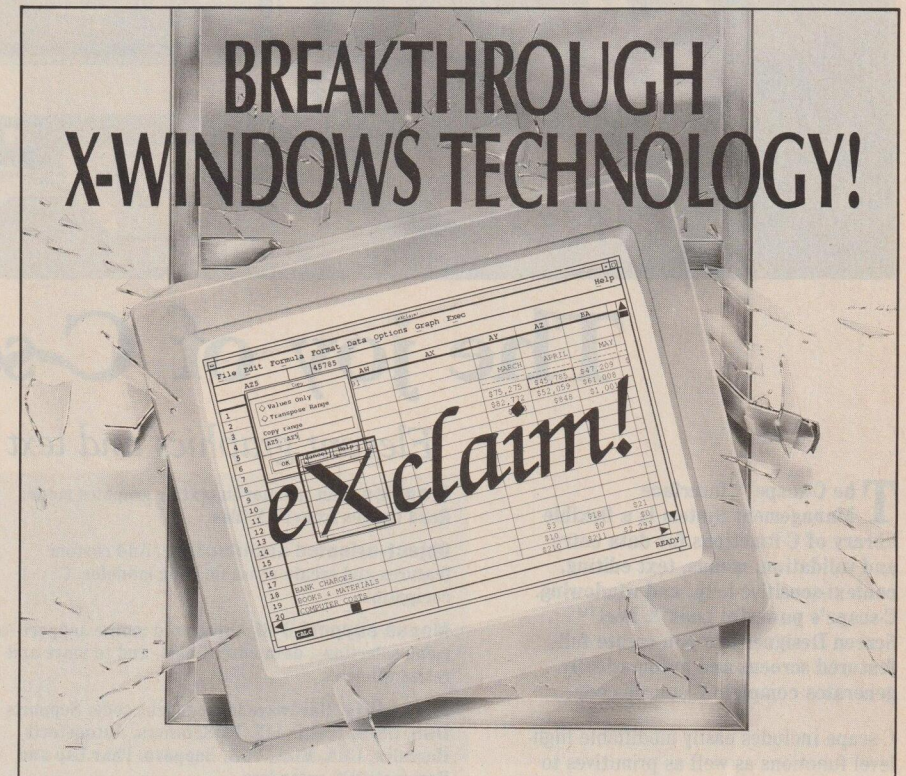
If you run under X Windows and Motif, you are an avant garde user. You would prefer not to use an ASCII-based program in an **xterm** window. You are also likely involved in a highly technical office, such as in software development, engineering, or in a large corporation. The number of X stations in your network is significant, so the logical choice is Synchronize.

As an X program, Synchronize is unobtrusive, but available when I needed it. Synchronize was not designed to be the "control center" of my computer existence, but rather an on-call assistant. And as with Clockwise, I would have preferred that Synchronize provided some method of searching through mutiple notes.

At the moment, Clockwise offers more features and its design scope is greater than Synchronize's. I do believe that Clockwise's databases could be better integrated, but this shouldn't stop you from buying it. If used correctly, it's the kind of software that can be a benefit to any business. And its $995 price, while higher per user than Synchronize, allows a low-cost entry into groupware.

Neither Synchronize nor Clockwise will disappear. Both products are the leaders for their respective companies and their timing in the UNIX market seems appropriate. Groupware is here to stay and PhaseII Software and Crosswind have made a solid commitment to it. You can't go wrong with either product, so long as users in your organization are willing to make the groupware commitment. ■

Rick Farris is a software designer and freelance writer working with firms in and around San Diego. He can be reached on the Internet as **rfarris@rfengr.com**.



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Menus. Pop-up, pull-down, 123-style, or slug menus; create your own.

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Code generation. Build any type of screen or form with the Look & Feel™ Screen Designer, test it, then automatically convert it to C code.

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CIRCLE NO. 177 ON INQUIRY CARD

Update by Frank Hayes

PLAYING THE SHELL GAME

If there's one area of UNIX that's managed to resist the trend toward standardization, it's UNIX shells. A shell is what other systems call a command processor or job control program. There seem to be as many different UNIX shells as there are versions of UNIX. And over the years, as UNIX versions have merged to form a more unified vision of open systems, the shells have become more numerous and diverse.

As a result, users can't count on which of many different shell prompts they'll face on a new system. If you're familiar with one particular shell, you may have to struggle in a different environment that doesn't work quite the same way. And not surprisingly, the situation is much more difficult for users approaching UNIX from proprietary operating systems. They have their own shell-like systems.

This is the kind of confusion that standards are supposed to solve. Actually, efforts to create a universal standard "shell" have been made in the past. Currently, standards committees are hard at work specifying the shell for Posix, the IEEE's project for creating an international vendor-independent standard for UNIX and UNIX-like operating systems. Paradoxically, that could create both a single standard *and* an explosion of different user interfaces.

Just Part of the Job

UNIX shells all work alike: the command processor displays a prompt, the user types a command, and the command processor executes the command, then displays the prompt again. Most systems also include the ability to send a previously stored series of commands (under UNIX, a "shell script") which are then executed in order.

That scripting ability is what makes both UNIX shells and other systems' command processors so useful. Computers, of course, are much better than humans at accurately repeating simple tasks. And most computer-based "jobs," whether compiling a program or running a spreadsheet or cranking out this week's payroll, involve issuing a series of commands to the operating system. Such commands include changing system parameters, making temporary copies of files, running an application, or performing housekeeping. Shell scripts automate those jobs. A single command typed by the user runs the script, which in turn issues the commands necessary to do the job without the chance of forgetting a step or mistyping a file name.

In fact, though most UNIX users use a shell interactively, command processors got their start strictly with scripts. The grand old man of modern shell scripting languages is IBM's JCL (Job Control Language). JCL was created in the 1960s for the then-new System/360 mainframe, IBM's first machine to offer multitasking. Running a job on a 360 originally required typing JCL statements on 80-column punch cards, then feeding them into a card reader. The JCP (Job Control Program) read the JCL statements, which could include both commands and input data, then executed the job.

Though most UNIX users use a shell interactively, command processors got their start with scripts

As computer systems evolved, different vendors developed their own styles of command processors. Command-processor languages offered control structures similar to conventional programming languages. Unlike conventional languages such as Cobol or Fortran, they weren't formalized by official standards organizations. Timesharing systems allowed operators to type in commands directly. And with the advent of minis and microcomputers using prepackaged commercial software, the command processor became the primary way in which many users interacted with their computers.

No Two Alike

But command processors for different computers were different. Some of the variations can be chalked up to technical differences between machine architectures. Even a simple operation like listing the names of a set of files on a disk used a different command on each system. For example, on an IBM mainframe running MVS, the command processor is TSO (for "timesharing operation," the interactive successor to JCL) and the command is LISTCAT. On a DEC VAX running VMS, the command processor is DCL and the command is DIRECTORY. On a PC running PC-DOS, the command processor is COMMAND.COM and the command is DIR.

By the early 1980s, there was enough interest in trying to simplify the Babel of command-processor languages that the international standards group, ISO, began a project to do just that. ISO's project was dubbed OSCRL, for "Operating System Command and Report Language," and it was an extremely ambitious project–a sort of universal input/output language for computers of all kinds. But most of those working on the project were of an academic, not commercial, bent. And though an outline for OSCRL was defined, major computer vendors weren't interested in implementing the language, because there was no demand for it among their customers.

Were those vendors just trying to fence in their customers with proprietary command processors? Maybe–but eventually, even IBM decided there were too many command languages around. IBM developed a new command language called REXX, which the company is now promoting as a com-

mand language for PCs, minis, and mainframes as part of its Systems Application Architecture. But old JCL scripts die hard. With a quarter-century of Job Control Language in use, it may be a long time before REXX will displace JCL or other proprietary command languages.

The UNIX Shell

In the meantime, UNIX made its debut–and with UNIX came UNIX- style shells. UNIX shells differ from proprietary command processors in two crucial ways. First, a UNIX shell isn't really a single command processor; it's actually a relatively simple utility that can run other UNIX programs for operations such as listing files. Thus, different UNIX shells use the same command, **ls**, to show the contents of a directory–and running a utility command is exactly the same as running a major application. Second, it's relatively easy to replace one UNIX shell with a different shell that's designed for a user's particular needs. And it's even easier to run one shell from within another. Those capabilities have resulted in a plethora of different incompatible shells–and that, in turn, is why different UNIX users may face different prompts, which demand different commands to get the same results.

There are some de facto standards. Virtually all UNIX systems come with AT&T's Bourne shell, **sh**, with its default "$" prompt. Systems with "Berkeley enhancements" usually also come with the Berkeley C shell, **csh**, which uses a "%" prompt as a default. AT&T also offers an enhanced version of the Bourne shell called the Korn shell, or **ksh**. Still other specialized shells include **bash** from the Free Software Foundation's GNU project, **vsh** from Microsoft, **tsh** from Tandy, and **sysadminsh** from The Santa Cruz Operation.

Each of these shells is incompatible with the rest, at least to some degree. Fortunately, if the shell you prefer is available on a system, you can always switch to it simply by typing its name–**sh**, **csh**, **ksh**, **bash**, or whatever. Unfortunately, if your favorite shell *isn't* available on a particular system, you'll just have to make do.

And if user habits aren't portable from one shell to another, neither are shell scripts. Unlike users, who can usually adapt to an unfamiliar shell's requirements, shell scripts that depend on a particular shell simply won't work if that shell's not around. As a result, most shell scripts are written in **sh**–the one shell that's always likely to be available.

A sh Is a sh Is a sh?

The good news is that there will be a standard shell for UNIX and UNIX-like operating systems. That's the mandate for the IEEE's Posix "shell and utilities" working group, 1003.2. But specifying a shell is only a part of the committee's job.

Like all Posix committees, the 1003.2 working group isn't simply trying to annoint existing software as a standard. Instead, the committee has outlined a set of characteristics that a Posix-compliant shell needs to have. That's allowed the committee to do a little mixing-and-matching of features in existing shells. For example, to maintain compatibility with most existing UNIX shell scripts, the Posix shell is based on the Bourne shell. Like the Bourne shell, the Posix shell will also be called **sh**. All Bourne shell scripts should also work on the Posix shell.

The Posix shell, however, isn't identical to Bourne. It includes some features of the Korn shell. As a result, Bourne-shell scripts will run successfully on the Posix shell, but Posix-shell scripts won't necessarily run successfully on the Bourne shell. And shell scripts designed to run under other shells, such as the Berkeley C shell, may not work at all.

The good news is that there will be a standard shell for UNIX and UNIX-like operating systems

And that's only the beginning of the committee's work. UNIX shell scripts largely consist of utility commands, each of which is a separate program–and each requiring its own specification. It's not easy to define a complex UNIX utility such as **awk**, **lex**, or **yacc** by its behavior; in the last year, most of the committee's descriptions of those utilities have undergone extensive revisions. Complicating matters is the fact that some commonly used UNIX utilities are actually based on proprietary algorithms, which raises a question of whether they should be adopted as standards. Patented technologies tend to make poor standards unless the patents can be easily licensed.

New utilities have been specified to meet the demands of international users. And the committee has even had to specify a dozen C-language functions to support shell programming, because the base Posix operating-system standard doesn't require the ability to run a shell at all.

Exploding Shells

And that's still not the end of the committee's work. In addition to standards to support shell scripts, the same committee is also defining utilities that are intended to be used interactively, such as screen editors. Those utilities are collectively known as the Posix User Portability Extension, or UPE. And a completely different working group, IEEE 1201.2, is working on the standards for windowing systems such as Open Look and Motif, which do some of the same work as shells.

1003.2 committee members readily admit that the Posix shell isn't intended as a universal command processor like OSCRL–it's just supposed to be a UNIX-like shell. Nonetheless, as Posix becomes a widely used standard, the Posix shell will become a required part of many UNIX and non-UNIX computer systems. Several proprietary system vendors have already announced that their systems will eventually conform to Posix standards–which means the Posix shell will become a universal command processor.

Won't that leave the current users of proprietary systems in a state of culture shock–suddenly forced to use a UNIX shell instead of their familiar command language? Paradoxically, no. Though the primary shell for a Posix system will be Posix **sh**, any other shell can still be run on top of it–including shells that implement proprietary command processors. UNIX shell versions of some proprietary command processors already exist; others can easily be created.

In short, the Posix shell standard could lead to an explosion of shells, making it far easier for users to shift between proprietary and UNIX-based systems. Proprietary users will keep their familiar prompts and job scripts, or try the Korn and Bourne and C shells. UNIX users, meanwhile, will have the chance to sample exotic flavors like Digital's DCL, Wang's VS, IBM's REXX, or even the original scripting language. IBM JCL, anyone? ■

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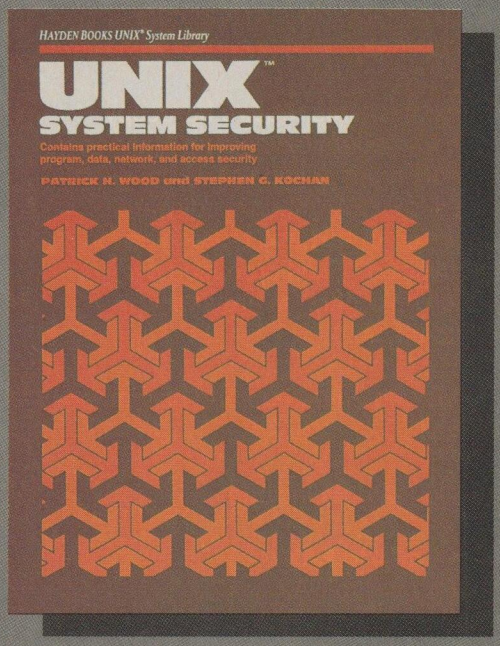

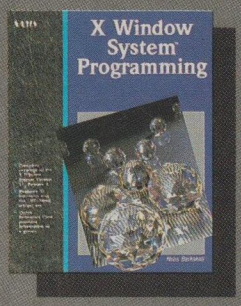

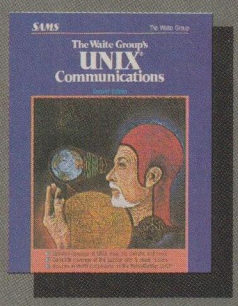

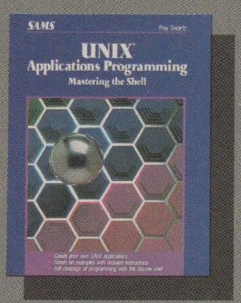

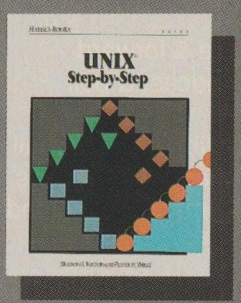

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C++ CLASS RELATIONSHIPS

This tutorial installment concludes our exploration of C++ with a discussion of class relationships, including containment and inheritance.

by Gail and Paul Anderson

Paul Anderson is president of Anderson Software, a UNIX training company specializing in courses on UNIX, C, and C++. Gail Anderson, co-founder of Anderson Software, designs and writes software in C++. They co-authored two textbooks: *The UNIX C Shell Field Guide* and *Advanced C: Tips and Techniques*. This article is copyright 1990, Gail and Paul Anderson, in Leucadia, Calif.

This is the third and final installment of a tutorial series on C++. In the first article we discussed data encapsulation—grouping object behaviors and data together and hiding the implementation. The second article dealt with user-defined data types and operator overloading, which allows you to create your own data types.

In this article, we look at some of the relationships we can define between classes, using these relationships to model objects more accurately. In doing this, we'll briefly touch on various aspects of C++, and give you a taste of the more advanced C++ capabilities. You may want to explore these topics further on your own, armed with some appropriate references.

A Basic Utility Class

In our exploration of class relationships, let's first look at a vector class that defines and maintains a "safe array" of homogeneous objects. They are homogeneous because each array object is alike and "safe" because the class detects out-of-bounds array references. Let's first look at a program that uses this class, and then we'll present the implementation.

Program `v1.C`, shown in Listing 1A, declares two vectors of integers, `vector a` and `vector b`. The program demonstrates several vector operations, including vector assignment (line 16), a vector copy constructor used for initialization (line 18), stream output (lines 15 and 17), a function that returns the vector's length, `length()` (line 12), and vector subscript operations. Subscripting is used both to retrieve values (as in line 19) and to set values within the vector (as in lines 13 and 20).

The program terminates with a run-time error in line 20 because the subscript expression `c[9]` exceeds the upper bound of 4 for vector `c`. The preprocessor statement in line 4, `#define ETYPE int`, makes the vector class element type, `ETYPE`, apply to `int`s. However, we could also manipulate a vector of `string s` (assuming we have a `class string` defined) or another class or built-in type. Listing 1B contains the output of program `v1.C`.

Vector Class Implementation. The implementation of `class vector` appears in Listing 1C. There are two private data members, `int len`, to hold the length of the vector (line 5), and `ETYPE *v`, a pointer to `ETYPE` (line 4). (Remember `ETYPE` is defined by the user of the class.) The constructors allocate storage for the desired number of vector elements (lines 7 and 8), and the destructor releases this storage (line 9). We've overloaded the assignment operator (line 11) and provided a copy constructor (lines 17-23). (Recall from last month's article that a copy constructor and an assignment operator are necessary for this class; the default C++ operations will not allocate the new storage required.) We've implemented a `length()` function (line 12) because we don't want to make data member `int len` public. (In general, all data members should be private to uphold the data encapsulation of the class.) Function `length()` returns the value of `len`. Strict data encapsulation is also the reason why we've provided a member function called `print()` (line 13) that `ostream operator <<` calls in its implementation (lines 53-57).

More interesting, however, is the implementation of the subscript opera-

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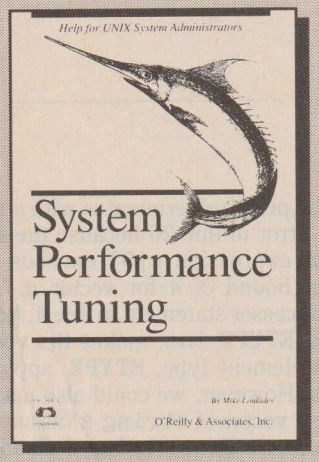

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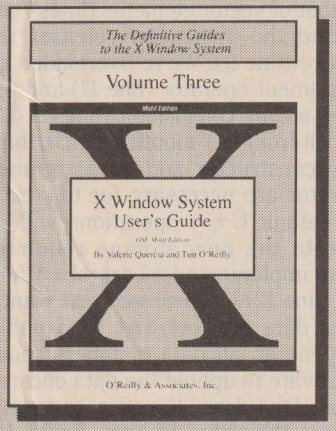

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LISTING 1: Program v1 illustrates the use of a vector class.

A. Listing of the `v1` *program source code:*

```
1  // v1.C: use vector class
2  #include <stream.h>
3  #include <stdlib.h>
4  #define ETYPE int
5  #include "vector.h"
6
7  main()
8  {
9     const int Max1 = 5;
10    const int Max2 = 10;
11    vector a(Max1), b(Max2);
12    for (int i=0; i < a.length(); i++) {
13       a[i] = i;
14    }
15    cout << "a = " << a << '\n';
16    b = a;                  // vector assignment
17    cout << "b = " << b << '\n';
18    vector c = a;           // vector initialization
19    cout << "c[3] = " << c[3] << '\n';
20    c[9] = 33;
21 }
```

B. Sample run of program `v1` *with output:*

```
$ v1
a = 0 1 2 3 4
b = 0 1 2 3 4
c[3] = 3
subscript 9 out of bounds
$ □
```

C. File `vector.h` *contains the* `vector` *class declaration and implementation:*

```
1  // vector.h - One dimensional safe array class
2
3  class vector {
4     ETYPE *v;
5     int len;
6  public:
7     vector(int size) { v = new ETYPE [size]; len = size; }
8     vector(const vector&);
9     ~vector(void) { delete[len] v; }
10    ETYPE & operator[](int);            //  a[i] --> a.operator[](i)
11    vector & operator=(const vector&); // b = a --> b.operator=(a)
12    int length(void) const { return len; }
13    void print(ostream &) const;
14 };
15
16 // copy constructor
17 vector::vector(const vector & v1)
18 {
19    v = new ETYPE [v1.len];
20    len = v1.len;
21    for (int i = 0; i < len; i++)
22          v[i] = v1.v[i];
23 }
24
25 // subscript operator:
26 ETYPE & vector::operator[](int i)
27 {
```

continued

tor function, `operator[]()` (Listing 1C, lines 26-33). Recall from last month's article that the statement `a[i] =3` is equivalent to `a.operator[](i) = 3`. Because we define the subscript operator function to return a reference (an address of a certain location), the function call may be used as an lvalue, and, for instance, the call `a.operator[](i) =3` puts 3 in the `i`th element of vector `a`. (Removing the reference for `operator[]()` using the prototype `ETYPE vector ::operator[] (int)` generates a compile-time error for an expression such as `a[i] =3`.) The same function is invoked when the subscript operation is used as an rvalue, as in `cout << a[3]`. Of course, before returning the vector element, the routine verifies that the supplied subscript parameter is within the vector's subscript

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range (lines 28-31), providing the safe array capability.

Design Implications. There is an implied relationship between type (or class) `ETYPE` and class `vector`. Class `vector` makes the following assumptions about `ETYPE`:

- It must be able to declare an array of `ETYPE`s because that's exactly what the `vector` assignment operator and constructors do.
- It must be able to use `operator <<` for `ETYPE` output.
- The assignment operator must be valid for `ETYPE` because both the vector copy constructor and vector assignment operator use `ETYPE` assignment (see lines 22 and 40 of Listing 1C).

These dependencies are not terribly restrictive; however, they are important to recognize. If, for example, you want to use class `vector` with your class `string`, but you've failed to provide an assignment operator for `string`, you could be in trouble. The compiler will generate a default assignment operator for your string class that is invoked with `v[i] = v1.v[i]`

Listing 1 continued

```
28      if (i < 0 || i >= len) {
29          cerr << "subscript " << i << " out of bounds\n";
30          exit(1);
31      }
32      return v[i];
33  }
34
35  // assignment operator:
36  vector & vector::operator=(const vector& v1)
37  {
38      ETYPE *nv = new ETYPE [v1.len];
39      for (int i = 0; i < v1.len; i++)
40              nv[i] = v1.v[i];
41      delete [len] v;
42      len = v1.len;
43      v = nv;
44      return *this;
45  }
46
47  void vector::print(ostream & os) const
48  {
49      for (int i = 0; i < len; i++)
50          os << v[i] << ' ';
51  }
52
53  ostream & operator <<(ostream & os, const vector & v1)
54  {
55      v1.print(os);
56      return os;
57  }
```


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(Listing 1C, line 22). While you will not be given any compilation errors, default assignment may produce erroneous results if your string class contains pointer data.

Containment

Continuing our study of class relationships, let's now define a `stack` class that uses class `vector`. Listing 2A shows a program (`s1.C`) that declares `stack s(5)` and uses member functions `full()`, `push()`, `empty()`, and `pop()` to manipulate the stack. It also uses function `length()` and operator `<<` for output. Listing 2B contains the output, and Listing 2C contains the implementation of class `stack` (file `stack1.h`).

Stack Class Implementation. In Listing 2C, the stack class uses a vector for its implementation. Here, `vector v` appears as a private data member of class `stack` (line 12) and is initialized in the member-initialization list `v(size)` (line 14) of the stack constructor. The member initialization list is the only way that we can pass initialization values (that is, constructor arguments) to data members that are themselves objects of another class. The `vector` class constructor is invoked automatically before the `stack` constructor executes.

LISTING 2: The use and implementation of class `stack`, using the previously defined class `vector`.

A. Program `s1` uses class `stack`. File `s1.C` contains the program source code:

```
1  // s1.C: use stack class
2
3  #define ETYPE int
4  #include "stack1.h"
5
6  main ()
7  {
8     stack s(5);
9
10    for (int i = 1; i <= s.length(); i++)
11       if (!s.full())
12          s.push(i);
13    cout << s << '\n';
14
15    while (!s.empty())
16       cout << s.pop() << ' ';
17    cout << '\n';
18 }
```

continued

The data member `int top` (line 11) keeps track of the top of the stack and is incremented after every `push()` and decremented before every `pop()`. Because the stack has a vector, we can use the vector's subscript operation to

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Listing 2 continued

B. Sample run of program s1 *with output:*

```
$ s1
5 4 3 2 1
5 4 3 2 1
$ □
```

C. File stack1.h *contains the* stack *class declaration and implementation using containment. Users of class* stack *must include this file in their programs:*

```
 1  // stack1.h - stack implementation using class containment
 2
 3  #include <stream.h>
 4  #include <stdlib.h>
 5  #include "vector.h"
 6
 7  const int maxlen = 100;
 8  enum boolean { false, true };
 9
10  class stack {
11     int top;
12     vector v;
13  public:
14     stack(int size = maxlen) : v(size) { top = 0; }
15     boolean empty() { return (boolean) (top == 0); }
16     boolean full() { return (boolean) (top == v.length()); }
17     void push(ETYPE n) { v[top++] = n; }
18     ETYPE pop() { return v[--top]; }
19     int length(void) const { return v.length(); }
20     void print(ostream &);
21  };
22
23  void stack::print(ostream & os)
24  {
25     for (int i = top-1; i >= 0; i--)
26        os << v[i] << ' ';
27  }
28
29  ostream & operator << (ostream & os, stack & s1)
30  {
31     s1.print(os);
32     return os;
33  }
```

access the stack's elements as required. Thus, the expression `v[top++] =n` (Listing 2C, line 17) invokes the subscript operator for `vector`, providing range checking. The functions `push()`, `pop()`, and `print()` all access the appropriate element within `vector v` using `vector`'s `operator[]()` function.

Because `vector v` is a *private* data member of `stack`, the public functions of `vector v` are available to stack member functions only. Therefore, we re-implement function `length()` (Listing 2C, line 19) to return `vector`'s `v.length()`. We also redefine function `print()` in `stack` to display its elements in stack order (last-in, first-out), not in vector order (first-in, first-out).

Containment Design Implications. What is the relationship between `stack` and `vector`? In this implementation, class `stack` *contains* a `vector`. We characterize this relationship as *Has-A* or containment: a `stack` has a `vector` in the same way that a person has a circulatory system, a bicycle has wheels, and a beach has sand. The `stack` class uses the `vector` class for its own purposes, hiding the low-level details of its implementation from the user. Furthermore, we have reused code, because the vector code already exists.

There are some other issues to explore. Should the expression `s[3] =1`, for example, be legal for `stack s(5)`? Probably not, because we'd like to restrict access to a stack's elements through the routines `push()` and `pop()`. In this implementation, we can't take the subscript of a `stack` because `operator []()` is not defined for `stack` (it's defined for `vector`). The subscript operation doesn't seem appropriate for a `stack` object.

Let's examine another design issue. Because routines `push()` and `pop()` invoke `vector`'s subscript function, they perform range checking for the

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LISTING 3. An alternate implementation of class stack uses C++ inheritance, deriving stack from vector.

A. File `stack2.h` *implements class* `stack` *using straight public inheritance:*

```
1  // stack2.h - stack using public inheritance
2
3  #include <stream.h>
4  #include <stdlib.h>
5  #include "vector.h"
6
7  const int maxlen = 100;
8  enum boolean { false, true };
9
10 class stack: public vector {  // derived from vector class
11    int top;
12 public:
13    stack(int size = maxlen) : vector(size) { top = 0; }
14    boolean empty() { return (boolean) (top == 0); }
15    boolean full() { return (boolean) (top == length()); }
16    void push(ETYPE n) { (*this)[top++] = n; }
17    ETYPE pop() { return (*this)[--top]; }
18    void print(ostream &);
19 };
20
21 void stack::print(ostream & os)
22 {
23    for (int i = top-1; i >= 0; i--)
24       os << (*this)[i] << ' ';
25 }
26
27 ostream & operator << (ostream & os, stack & s1)
28 {
29    s1.print(os);
30    return os;
31 }
```

B. File `stack2a.h` *shows the differences from A required to implement* `stack` *using public inheritance but limiting certain behaviors for* `stack` *found in* `vector`*:*

```
1  // stack2a.h - stack using public inheritance
2
3  class stack: public vector {  // derived from vector class
4     int top;
5     ETYPE& operator[](int i) { return vector::operator[](i); }
6  public:
7     stack(int size = maxlen) : vector(size) { top = 0; }
8     . . .
9  };
10    . . .
```

C. File `stack2b.h` *shows the differences from A required to implement* `stack` *using private inheritance and providing certain behaviors for* `stack` *found in* `vector`*:*

```
1  // stack2b.h - stack using private inheritance
2
3  class stack: private vector {  // derived from vector class
4     int top;
5  public:
6     vector::length;   // access declaration
7     stack(int size = maxlen) : vector(size) { top = 0; }
8     . . .
9  };
10    . . .
```

`stack`. Yet the routines `empty()` and `full()` also provide range checking. Are we being redundant? In a sense, yes. If a programmer makes judicious use of `empty()` and `full()` with every stack access, then range checking in `push()` and `pop()` is redundant. However, there's no way to enforce a programmer to use `empty()` and `full()`, so it's probably better to include range checking within `push()` and `pop()` as well. Later, we'll look at a different approach in solving this problem.

Note that we did not define a copy constructor or an assignment operator for class `stack`. Why not? Recall from last month's article that the default copy constructor and assignment operator perform member-wise copies of each of its data members. Thus, `s = t` where `s` and `t` are declared `stack`, executes `s.top = t.top` and `s.v = t.v`. Because the expression `s.v = t.v` invokes the `vector` assignment operator, `(s.v).operator=(t.v)`, the default assignment is appropriate for this class.

We also did not include a destructor for `stack`. A class's default destructor invokes the destructors for each of its members, if one exists. Therefore, the default `stack` destructor invokes the `vector` destructor for data member `v`, properly releasing the storage that the `vector` constructor allocated.

Inheritance

C++ inheritance allows you to implement new classes by adding to or specializing another class's behavior. This new class is the *derived class*, and the existing class is the *base class*. A derived class object consists of the base class object, including the base class data members and functions. In addition, the derived class may add to the base class's functionality by providing new behaviors. Inheritance gives C++ a richness not possible with simple containment. Because derived class objects *inherit* the behaviors from its base class, a derived class object truly is a base class object (and then some). Let's look at some examples of inheritance by re-implementing class `stack`.

Refer to Listing 2A and 2B for the user program and output, respectively, because it's exactly the same user code we've provided with the first stack implementation. The implementation of `stack` using inheritance is different from containment, however, which we show in Listing 3A. Now we *derive* class `stack` from class `vector`. We are saying that class `stack` is a kind of `vector`. And, it is certainly valid to think of a `stack` as a specialized kind of `vector`.

Stack Class Implementation. The keyword `public` (Listing 3A, line 10) means that all of `vector`'s public members are public members in `stack`. Thus, if we define `vector v(10)` and `stack s(5)`, `v.length()` invokes the `length()` function for vector object `v`. Similarly, `s.length()` invokes the (inherited `vector`) `length()` function for stack object `s`. However, class `vector` private data members are still private to class `stack` and users of class `stack`. Therefore, the expression `top == len` within a `stack` member function is illegal. But, the expression `top == length()` is valid (see Listing 3A, line 15) because it uses the inherited

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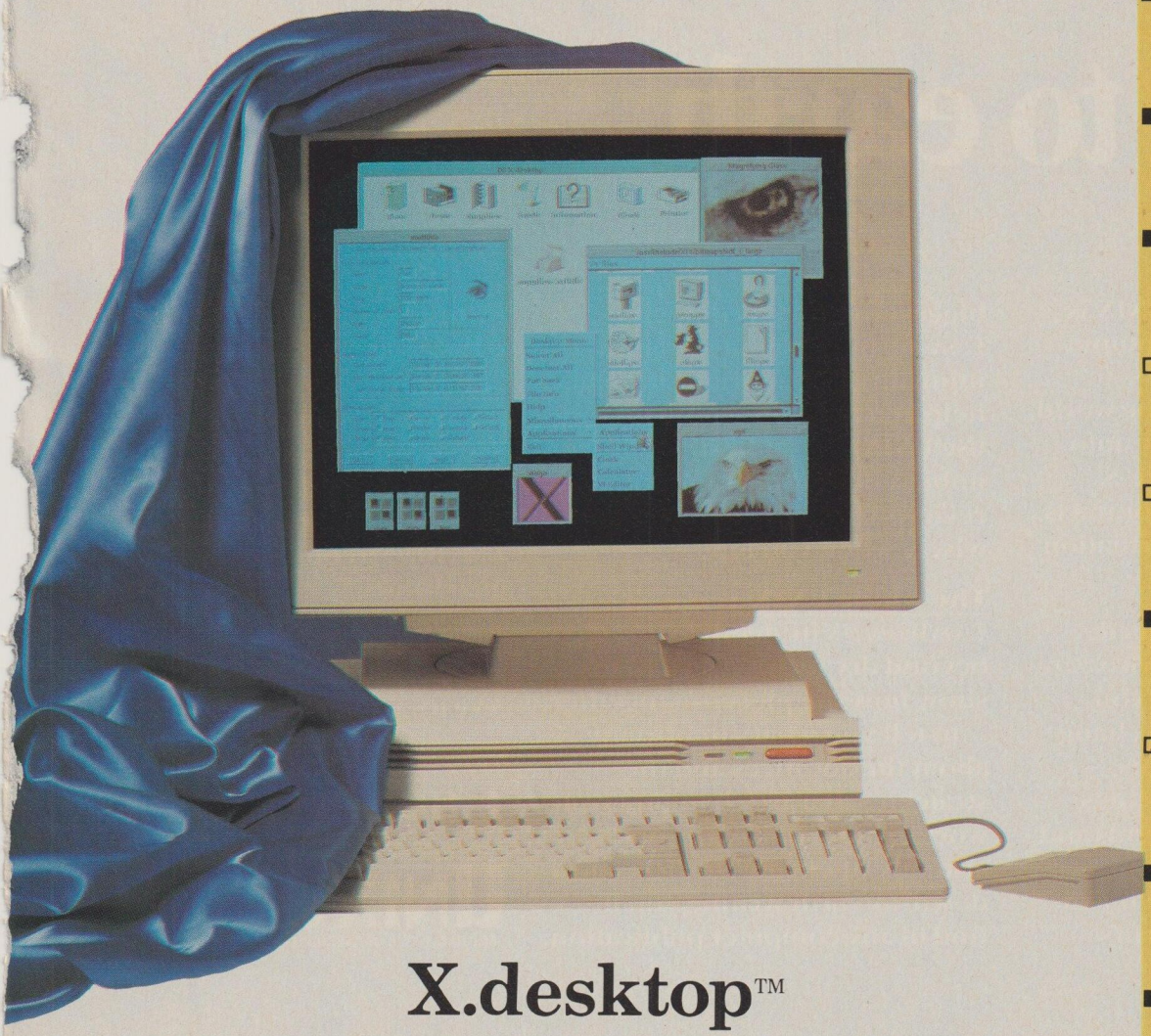

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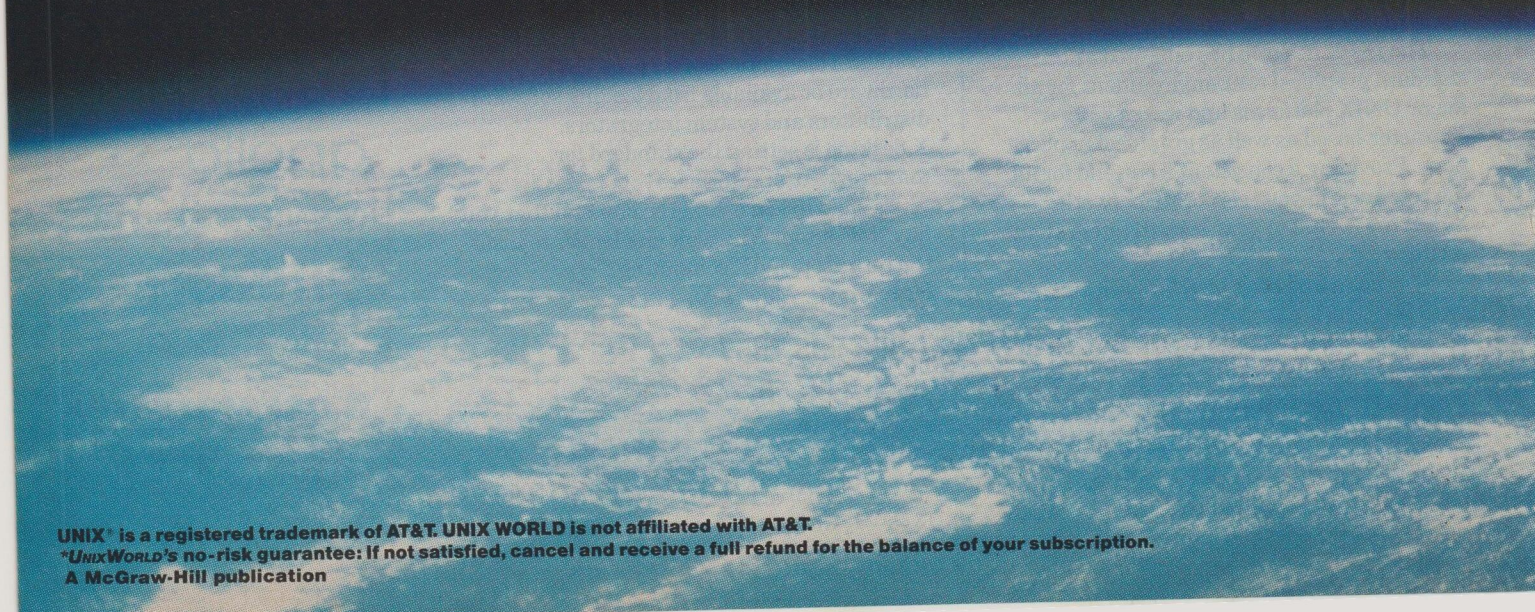

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public function.

As with containment, the `stack` constructor initializes `vector` through the member-initialization list `vector(size)`, passing parameter `size` to its base class constructor, `vector::vector(int)` (Listing 3A, line 13). The `vector` constructor executes before the code in the `stack` constructor. The `stack` destructor (we use the default destructor) invokes the destructor for its base class automatically. Thus, storage is properly allocated in the constructor and released in the destructor. The assignment operator and copy constructor are straightforward, as well. The default operations use member-wise assignment and copying, respectively. Member-wise operations apply equally well to base class members as "contained" members. Therefore, the default operations are valid for class `stack` derived from class `vector`.

The implementation of `stack` functions `push()` (Listing 3A, line 16) and `pop()` (Listing 3A, line 17) invoke the subscript operator function `operator`

LISTING 4. We now re-implement class `vector` using the `protected` keyword to alter the access for its data member `v`.

A. File `vector.h` *shows the changes required from the original implementation in Listing 1C:*

```
1  class vector {
2     int len;
3  protected:
4     ETYPE *v;
5  public:
6     vector(int size) { v = new ETYPE [size]; len = size; }
7     . . .
8  };
9     . . .
```

B. File `stack2c.h` *shows the changes that take advantage of* `vector`*'s* `protected` *data member* `v`*:*

```
1  // stack2c.h - stack using private inheritance
2
3  class stack: private vector {  // derived from vector class
4     int top;
5  public:
6     vector::length;   // access declaration
7     stack(int size = maxlen) : vector(size) { top = 0; }
8     . . .
9     void push(ETYPE n) { v[top++] = n; }
10    ETYPE pop() { return v[--top]; }
11 };
12    . . .
```


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`[]()` inherited from `vector`, using the expressions `(*this)[top++]` and `(*this)[--top]`. Recall that the pointer `stack *this` refers to the invoking object. An equivalent expression is `this->operator[](top++)`, which calls the inherited subscript function directly. We can also leave off `this->` and use `operator[](top++)`. Thus, the expression `s.push()` for `stack s` evaluates to `s[s.top++]` (`*this` will be the object `s`). Similarly, the `print()` routine uses the subscript function on the invoking object `(*this)[i]` (Listing 3A, line 24) to display each element in the last-in, first-out stack order.

Inheritance Design Implications. By deriving `stack` from `vector` we are saying that a `stack` *Is-A* `vector`, although its behavior is specialized. This is analogous to saying a Volkswagon is a car, an island is land, and a lawyer is a person (no jokes, please). As with containment, we have good code reuse. In fact, we do not have to implement `stack::length()` because `stack` inherits `vector::length()` directly.

Now, before you go off and start deriving classes from other classes, consider the question, "Is the expression `s[3] = 1` legal for `stack s(5)`? Using our `stack` inherited from `vector`, as in Listing 3A, the answer is yes, the expression is legal! While the subscript expression is safe (that is, within the bounds for the vector), we've already stated that we want to exclude this behavior for a `stack` object.

There are two ways to handle limiting the behavior of a derived object: One way is to state that the derived object (here, `stack`) is just like its parent (class `vector`), except we'd like to disallow certain behaviors (like the subscript function). Alternatively, we state that the derived object is a very specialized instance of its parent, and we'd only like to provide a small subset of its parent's behaviors.

Public and Private Derivations. Let's demonstrate the first solution in Listing 3B, showing only the code that has changed from Listing 3A. We've removed the inherited `operator[]()` from `stack`'s public functions by redefining it specifically for `stack` and placing it in `stack`'s private area. Now `operator[]()` is available within `stack` member functions, but is inaccessible outside of them. With this implementation, the expression `s[3] = 1` for `stack s` generates a compilation error. Using this solution, we need to examine each public member of `vector` and determine which behaviors should *not* be available for users of `stack` objects. We must then re-implement each function we want to limit in the private area.

The second approach is illustrated in Listing 3C. Here, we use the keyword `private` to derive `stack` from `vector`. Private derivation means that the base class public member functions become private to users of the derived class. Base class public member functions are still accessible to the derived member functions, however. This means that all of `vector` public functions are *only* available within `stack` member functions. Thus, the expression `(*this)[top++]` within function `stack::push()` calls the function `vector::operator[]()`. The expression is legal because `push()` is a derived class *member* function and can access `vector`'s public functions. However, the expression `s[3] = 1` for `stack s(5)` generates a compilation error because the function `vector::operator[]()` is now private to users of class `stack`.

Note that with the second approach we have restricted *all* of `vector`'s public functions by declaring `stack` a private derivation of `vector`. Consequently, we need to examine each public member of `vector` and determine which behaviors to make available to users of `stack` objects. We must then declare these functions within `stack`'s public area. Listing 3C, line 6 declares `vector::length` to have public access even though `stack` is derived privately from `vector`. Without this access declaration, function `vector::length()` cannot be accessed by users of class `stack`, and the expression `s.length()` (see Listing 2A, line 10) generates a compilation error.

Protected Class Members. Let's return now to the redundancy problem we raised earlier: that the implementation of `stack::push()` and `stack::pop()` has function call overhead to perform range checking that is also performed by routines `empty()` and `full()`. The solution we present here is a classic problem in design tradeoff: efficiency vs. safety. Modifications are required in two places. First, we

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Listing 3 continued

```
151  void quit(message, status)
152  char *message; int status;
153  {
154  #ifdef S5   /* System V */
155      resetterm();    /* restores modes changed by setupterm */
156  #endif  /* System V */
157      printf("%s\n", message); /* reason for quiting */
158      exit(status);   /* exit with status code */
159  }
```

B. A `make`*-description file you can use to compile the lock program:*

```
#
# Make lock program using appropriate terminal routines
#
CFLAGS = -O -s
#
# AT&T terminal routines:
#
s5:     lock.c
        $(CC) $(CFLAGS) -DS5 -o lock lock.c -lcurses
#
# BSD terminal routines:
#
bsd:    lock.c
        $(CC) $(CFLAGS) -DBSD -o lock lock.c -ltermcap
#
```

ment you would need to lock the keyboard and mouse focus, else an unauthorized user could always select an unlocked window, if available, or perhaps create a new window.]

This program can also be used when the user has logged in to a remote system on a network. The only caution here is: the network utility you are using should allow you to change the default escape sequence. In our XNS environment, a `visit` command is used to initiate a connection with a remote node. By using the `-e` option with this command, the user can and should change the escape sequence that allows him or her to terminate the XNS session. If the default escape sequence is left set up, then someone could use it to break out of the `visit` command. The user would not gain access to the remote node, but he or she would now have access to the local node. TCP/IP protocols also provide the means for changing these escape sequences. For `rlogin`, use the `-e` option, and for `telnet`, use the `set escape` command.

In conclusion, a terminal locking program like this can be easy to use and implement by placing a copy in a local command directory in your user's search path. Instruct users on its purpose and network and windowing environment cautions and you'll be set to go.

Steve Glenn
Senior Software Analyst
Intergraph Corp., Huntsville, Ala.

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Briefly describe the hardware and software environment (especially the UNIX system version) on which the contributed code was run.

If possible, you should write code that is portable across the popular versions of the UNIX system (System V.X, 4.XBSD, XENIX). Write Bourne or Korn (but not C) shell scripts and use universally available utilities, for example, `who am i` (all systems) instead of `whoami` (Berkeley only). If feasible, use `getopts`(1) or `getopt`(3C) to process command-line options and their arguments.

Use the standard I/O library for structured modular C code. Check source code for nonportable constructions with `lint`. Eliminate hardware dependencies, such as terminal control sequences. (Use `termcap` or `terminfo`.) Isolate nonportable code to one region or a separate module. Keep examples compact (under 100 lines of code with each line less than 65 characters long—counting tabs as 4 spaces) and explanations concise (under 400 words). Use `sed` instead of `ed` scripts, pipelines instead of intermediate temporary files, etc. Be succinct! ■

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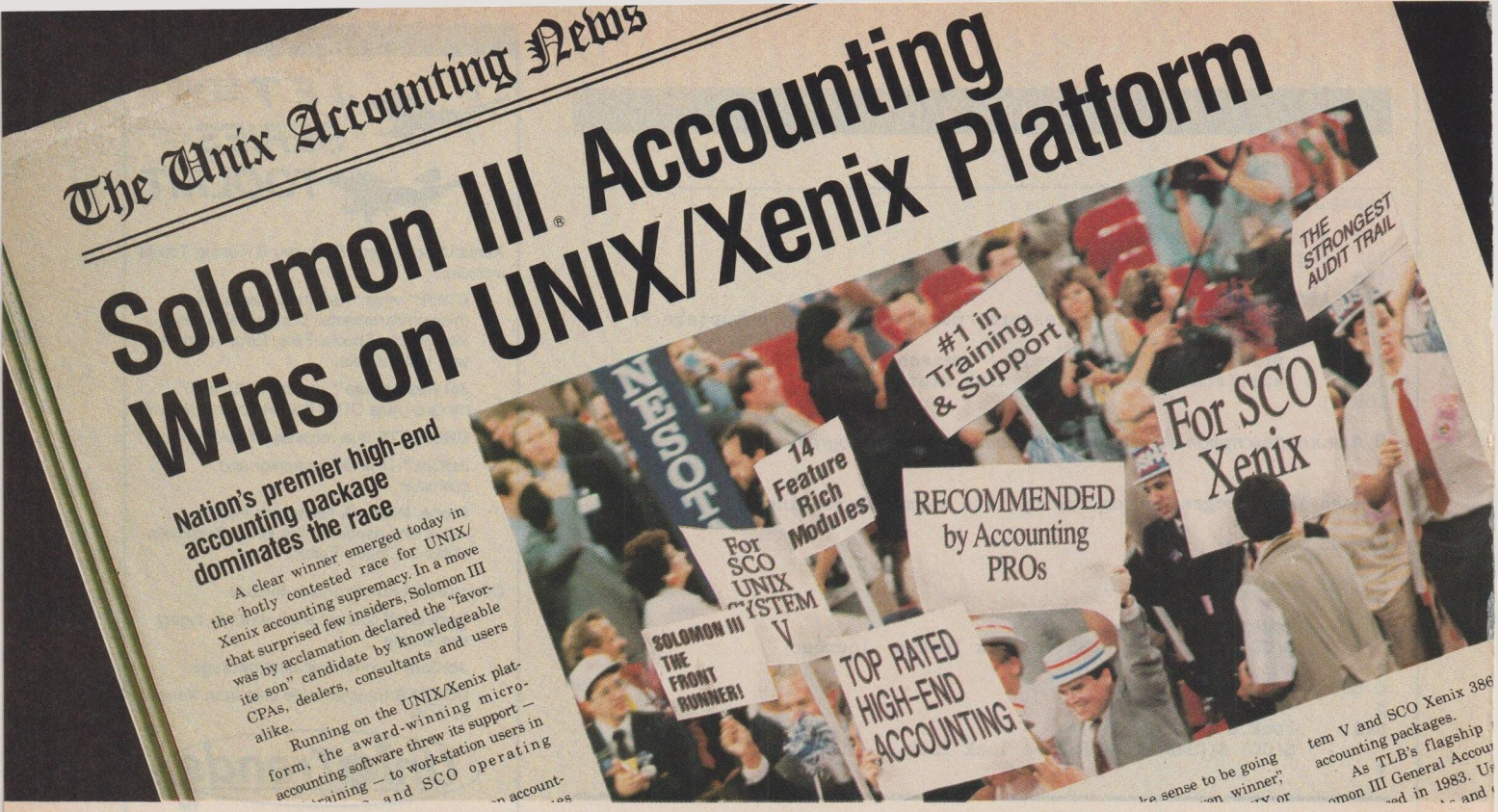

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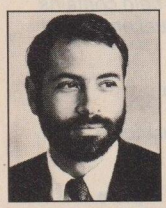

RESTRICTIONS, COMMAND DISPLAY, AND LP-PRINTED FILE COPY

Three readers have problems to solve. Wilson Hargrove wishes to restrict the commands that novice users can execute. One solution is to use a restricted log-in environment, implemented with a "restricted shell." Wilma Belmanic asks how to display all the commands that a user can execute. My answer shows two implementations: one uses a C program, and the other, a shell script wrapper for two `awk` programs. Finally, Doug Robinson wants to make a disk copy of a file while it's being printed by the LP system. My approach runs `cp` from the printer's interface script.

Restrictions May Apply

Question: I'm an administrator on a machine with several users whose UNIX experience varies greatly. I'd like to limit the commands the less experienced users can run to save me the trouble of bailing them out of awkward situations. However, many of these beginning users need to access large data files that help run our company. Is there some way I can limit the commands users can run, yet give them complete access to the data files on the system?

Wilson Hargrove
Pensacola, Fla.

Answer: There are two common approaches to selectively restricting access to commands: Create a separate file system "change-root" environment for each restricted user, or establish custom command directories enforced with a "restricted shell." Although the first approach is quite secure, it does limit access to the file system hierarchy. The second approach accomplishes your goal, but it's not as secure—a knowledgeable user may "break out" into a non-restricted shell. However, because the environment is for "less experienced" users, the restricted shell approach should be adequate for your needs.

Before continuing, let me review how users are given access to UNIX commands. Conventionally, most commands for ordinary users are executable files located in the `/bin` or `/usr/bin` directories. [*Editor's note:* Most SVR4 user-level commands are in `/usr/bin` with `/bin` a symbolic link to `/usr/bin` for backward compatibility.] However, commands are usually executed by simply entering their file base names, not a full path name. Thus, the UNIX system has to provide a way to locate a command's executable file when all it knows is the command's file name.

The `PATH` environment variable references a colon-separated list of directories often called a user's "command search path," or simply "search path." When a user types a command's file name, the shell searches each directory (in the order listed in `PATH`) for the command's executable file. The key is to restrict access to commands through proper definition of the search path. The restricted modes of the Bourne and Korn shells support this approach. These shells act like their non-restrictive counterparts, except that the following operations are disallowed:

- Changing directory (with `cd`)
- Setting `PATH` or `SHELL` (also `ENV` with Korn shell)
- Specifying command names using a slash (`/`)
- Performing output redirection (using `>` or `>>`) and using `>|` or `<>` with the Korn shell
- Cannot "exec" programs

Note that these restrictions apply after the `.profile` file (and `ENV` Korn shell file) of the account user has been interpreted by the log-in shell.

Creating a restricted shell/restricted environment consists of several steps:

- Specify a restricted shell for the log-in program.
- Add commands to the user's `.profile` file (or Korn shell `ENV` file) that support a restricted environment.
- Create one or more special directories containing only the commands you wish the new user to run.

To accomplish the first step, you can specify that an account use a restricted log-in shell in several ways. With

TABLE 1: Many commands are relatively "safe" to provide the restricted account user if you've set up their working environment correctly. Here's a partial list:

awk	cp	file	lpstat	pg	spell	tr
banner	cu	grep	ls	pr	stty	tty
cal	cut	head	mkdir	ps	sum	uname
cancel	date	id	more	red	tail	uniq
cat	df	join	mv	rm	tee	unpack
chmod	diff	kill	pack	sed	touch	vi
cmp	du	ln	passwd	sort	tput	who
comm	env	lp				

***Note:* Both `mail`, `mailx`, and `write` are security risks since other users could send escape sequences that cause security problems.**

TABLE 2: Several UNIX system commands use the `SHELL` environment variable to determine the shell identity for a shell escape. Here's a partial list:

cu	find	mail	mailx	more	pg	write	vi

Method 1, specify the full path name of the `rsh` (or `rksh`) executable in the last field of the password file entry (see Listing 1A). In Method 2, "exec" a shell (from `.profile` or Korn shell `ENV` file) that has `rsh` (or `rksh`) as the file base name. Method 3 calls for you to "exec" a shell (from `.profile` or Korn shell `ENV` file) with the `-r` option. Note all these methods work on SVR4, but they may not all work on other UNIX versions.

However, a problem may arise with the first two methods if your system supplies Berkeley networking r-commands, which include `rsh`, the remote shell command. To prevent confusing the remote shell with the restricted one, you could create a link to or copy of `sh` named `rsh`. Place it in a directory not in the usual command search path, and specify the `rsh` linked or copied file using the full path name.

[*Editor's note:* My SVR4 system supplies a symbolic link file (named `/usr/lib/rsh`) that maps to the standard Bourne shell (named `/sbin/sh`). The remote shell executable has path name `/usr/bin/rsh`. Of course, the `/usr/lib` directory is generally not in a user's command search path.]

There are some setup steps you need to perform in the user's log-in shell profile file. First, if you're using Methods 2 or 3, you'll need to trap the keyboard-generated interrupt and quit signals to have the log-in shell exit. Method 1 takes care of these signals automatically.

Then, set `PATH` to specify only the directory or directories that you will populate with the allowed commands. Table 1 shows some possible candidates. *Caution:* Don't include the current directory in `PATH` and don't provide commands like `env`, a shell, or a compiler, as a hostile user could use them to break out into a non-restricted shell. Make sure the user can't write into any directory in his or her search path, else the user could install a command of his or her own choosing. Use of this restricted environment requires constant vigilance by the system administrator to make sure security is maintained.

Next, you should set the `SHELL` environment variable so `rsh` (or `rksh`) is the base name of its value. Then a restricted shell will be used when a user employs a shell escape from a command that determines the shell to run from the `SHELL` variable. Table 2 lists some commands that use `SHELL` this way.

LISTING 1: You can use the restricted mode of the Bourne or Korn shell to establish a "controlled" environment for a system user.

A. A typical password file entry to run a restricted Bourne shell. (The second field contains an "x" because the shadow-password file, `/etc/shadow`, contains the actual encrypted password string.)

```
newuser:x:180:200:Restricted Account:/home/newuser:/bin/rsh
```

B. Long directory listing for the home directory and `.profile` file for the restricted account user:

```
# ls -ld /home/newuser /home/newuser/.profile
drwxr-xr-x  3 root   other     80 Nov 22 10:31 /home/newuser
-rw-r--r--  1 root   other    125 Nov 22 13:13 /home/newuser/.profile
# □
```

C. A Method 1 `.profile` file:

```
PATH=/usr/rbin # Restricted command directory
SHELL=/bin/rsh # Use /usr/lib/rsh on SVR4
export PATH SHELL
cd workdir     # Change to final working subdirectory
```

D. A Method 2 `.profile` file:

```
trap 'exit' 2 3        # Exit if user types interrupt or quit keys
PATH=/usr/rbin # Restricted command directory
SHELL=/bin/rsh # Use /usr/lib/rsh on SVR4
export PATH SHELL
cd workdir     # Change to final working subdirectory
exec /bin/rsh  # Use /usr/lib/rsh on SVR4
```

E. A Method 3 `.profile` file:

```
trap 'exit' 2 3        # Exit if user types interrupt or quit keys
PATH=/usr/rbin # Restricted command directory
SHELL=/bin/rsh # Use /usr/lib/rsh on SVR4
export PATH SHELL
cd workdir     # Change to final working subdirectory
exec /bin/sh -r        # Replace log-in shell by a restricted version
```

Finally, you should have the log-in shell change to a subdirectory, which will be the working directory for the account user. This way there's less chance the user can alter the working environment. Of course, neither the account home directory nor the profile file in that directory should be owned or writable by the account user. Listing 1B shows a long directory listing example for a typical home directory and `.profile`.

Part C of Listing 1 shows a sample `.profile` suitable for Method 1, Part D for Method 2, and Part E for Method 3. All three examples redefine `PATH` and `SHELL`, and change to the `workdir` subdirectory. However, only Methods 2 and 3 need to trap the keyboard-generated signals.

Because both the restricted Bourne and Korn shells will run a shell procedure with the unrestricted version, you could provide the end user with a shell program that has access to the full power of the standard shell, yet impose a limited menu of commands. Thus, this represents another reason you shouldn't allow a user to have write permission in any of the directories in his or her search path, else the user could create his or her own custom shell scripts and break out of the restricted environment.

[*Editor's notes:* Also, be careful with versions of the Bourne shell based on Version 7 UNIX. They allow you to reset `PATH` or `SHELL` using the `read` command, as in `read PATH`. We wish to thank both Patrick Wood and Rik Farrow for their helpful suggestions regarding the restricted shell environment outlined here.]

On The Right `PATH`

Question: A user on my system asked if there's a way to see all the commands someone can run. I know that the command directories are listed in `PATH`, but I don't know how to display the names of the files a user is allowed to execute in those directories.

Wilma Belmanic
Atlanta, Ga.

Answer: Before I provide a solution,

LISTING 2: Finding all the executable files in a user's search path can be done by following the contents of the PATH variable. This can be done with either a C program (see Part A) or a shell script (see Part B).

A. Listing of the `xtest` *program:*

```
 1  #include <stdio.h>       /* standard I/O definitions */
 2  #include <sys/types.h>   /* data type definitions */
 3  #include <sys/file.h>    /* file type definitions */
 4  #include <dirent.h>      /* file system-indep. directory defns. */
 5  #include <sys/stat.h>    /* defines stat structure */
 6  #include <unistd.h>      /* defines X_OK to be 1 */
 7  char SccsID[] =
 8    "@(#) xtest.c: Find user-executable commands; Ray Swartz, 11/90";
 9  main(argc, argv)
10  int argc; char *argv[];
11  {
12      char    *name, *getcwd();   /* directory name strings */
13      void    checkdir();         /* declare return type */
14
15      if (argc < 2) {         /* if no supplied arguments */
16          name = getcwd((char *)NULL, 64); /* get current dir */
17          checkdir(name);     /* report executables in dot */
18      } else {
19          while (--argc) {    /* while another argument */
20             name = *++argv; /* store directory name */
21              if (strcmp(name, ".") == 0) /* if current dir */
22                  name = getcwd((char *)NULL, 64);    /* get path */
23              checkdir(name); /* report executables */
24          }
25      }
26  }
27  void checkdir(dirname)
28  char *dirname;
29  {
30      DIR             *opendir(), *dirP;  /* directorys */
31      struct dirent   *readdir(), *direntP;   /*directory entries */
32      struct stat     statbuf;        /* file status struct buf */
33      char            pathname[BUFSIZ];   /* storage for path */
34
35      if (stat(dirname, &statbuf) < 0) {
36          fprintf(stderr, "Can't stat %s\n", dirname); return;
37      }
38      if ((statbuf.st_mode & S_IFMT) != S_IFDIR) {
39          fprintf(stderr, "%s not directory\n", dirname); return;
40      }
41      if ((dirP = opendir(dirname) ) == NULL) {
42          fprintf(stderr, "Can't open %s\n", dirname); return;
43      }
44      /* loop through directory data blocks: */
45      while ((direntP = readdir(dirP)) != NULL) { /* not end of dir */
46          /* construct full path name for directory entry: */
47          sprintf(pathname, "%s/%s", dirname, direntP->d_name);
48          if (stat(pathname, &statbuf) < 0) {
49              fprintf(stderr, "Can't stat %s\n", direntP->d_name);
50              continue;   /* try next directory entry */
51          }
52          if ((statbuf.st_mode & S_IFMT) != S_IFREG)
53                  continue;  /* only check ordinary files */
54          if (access(pathname, X_OK) == 0)    /* user can execute */
55              puts(pathname); /* so display path name */
56      } /* end of while loop */
57      closedir(dirP); /* close directory file */
58  }
```

continued

let's review the file-permission tests made by the kernel:

- If the user has superuser privilege, he or she can execute any ordinary file as a command.
- If the user owns the file, he or she can execute the file as a program if individual owner execute permission is enabled, but not if it's disabled.
- If the user is a group owner (but not an individual owner), he or she can execute the file as a program if group execute permission is enabled, but not if disabled.
- Other users (not individual or group owner) can execute the file as a program if execute permission for the other user category is enabled.
- Shell scripts also require read permission so they can be interpreted.

continued

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Listing 2 continued

B. Listing of the showex *shell script:*

```
:
# @(#) showex -- Find user-executable commands in a directory
# Author: Ray Swartz, Nov. 1990
# Process command line arguments:
case $# in
    0) Args="." ;;  # No arguments, search current directory
    *) Args="$*" ;; # Store user-specified arguments
esac
# Get user- and group-id of script operator:
set `id |
awk '{  for (i = 1; i <= NF; i++) { # for all fields in line
            if ($i ~ /^[ug]id/) # if has string uid or gid
                print $i        # output it
        }
}' | sed -e 's/^.*=//' -e 's/(.*$//'` # retrieve ID number
Uid=$1  # Store user-id number
Gid=$2  # Store group-id number
# Test to see if ls recognizes option (-L) to follow sym links:
if ls -L >/dev/null 2>&1 ; then # ls recognizes -L
    Ls="ls -L"  # use this option
else
    Ls=ls       # don't specify this option
fi
# Scan the target directory:
for Pname in $Args ; do # for all directory arguments
    [ $Pname = "." ] && Pname=`pwd` # get full path for dot dir
    $Ls -ln $Pname | # long listing with user, group numbers
    sed -e '/^total/d' -e '/^[^-]/d' | # pass ordinary files
    awk '$3 == '$Uid' { # if user owns file
        if ($1 ~ /^...[sx]/)        # if executable
            print "'"$Pname"'/"$9    # display path name
        next }  # get next line
        $4 == '$Gid' {  # if user a group owner
        if ($1 ~ /^.....[sx]/)      # if executable
            print "'"$Pname"'/"$9    # display path name
        next }  # get next line
        $1 ~ /x$/ {     # # if executable by others
            print "'"$Pname"'/"$9   # display path name
        }'  #
done
```

C. Printing the executable files in a user's search path:

```
$ xtest `echo $PATH | sed 's/:/ /g'`
[ list of user-executable files ]
$ □
```

I've provided two approaches for determining if a user can execute a file. The first is a C program based on the `access()` system call. The other is a shell script that tests the permissions listed by `ls -l`. While the C program is much faster, it is not as portable as the shell script.

The `xtest` C program (Listing 2A) reads through its directory arguments, testing each file in each directory with `access()`. Because `xtest` is trying to find executable files, it ignores file types that aren't ordinary files. Also, as `xtest` relies on the file-system independent directory access routines (see `directory(3C)`), it isn't portable to (generally older) UNIX system implementations without these routines. If your system can't compile `xtest` you could use our `showex` shell script, shown in Listing 2B.

The main problem with using a shell script to check executables is determining the identity of the user running the script. In `xtest` this problem is handled by using `access()`. In the shell script, you have to do it explicitly with the `id` command. If your system supports symbolic links, you'll need to invoke `ls` to "follow the link" instead of report on the link file itself. SVR4 `ls` recognizes the `-L` option to accomplish this task.

Even though both `xtest` and `showex` display all user-executable files, the report provided by `showex` is ordered because `ls` sorts the files in a given directory. However, `xtest` displays the files in the order they occur in the directory data block, but you can pipe the output of this pro-

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- ❑ B. Design and Implementation
- ❑ C. Management
- ❑ D. Other (Specify) _____
- ❑ E. No Involvement

2. Which of the following best describes your involvement in the purchase of data communications and networking equipment and services? (check all that apply)
- ❑ A. Specify
- ❑ B. Recommend
- ❑ C. Purchase
- ❑ D. Approve Purchase
- ❑ E. None

3. Which is your company's primary business activity at your location? (Check only one)
- ❑ A. Manufacturing: Computers/Communications
- ❑ B. Carrier: Including AT&T, B.O.C.s, Independent Telcos, Public Data Networks
- ❑ C. Value Added Reseller/Dealer, System House/Distributor, Interconnect Company, Integrator, Computer/Communications
- ❑ D. Computer/Communications Services: Software, Service Bureaus, Time Sharing
- ❑ E. P.T.T.
- ❑ F. Other Manufacturing (other than Computers/Communications)
- ❑ G. Trade: Wholesale/Retail
- ❑ H. Finance: Banking, Real Estate, Insurance
- ❑ I. Transportation
- ❑ J. Utilities: Gas & Electric
- ❑ K. Government: Federal, State, Municipal & County
- ❑ L. Medical/Legal/Education
- ❑ M. Consulting
- ❑ N. Other _____

4. What is your job function? (check only one)
- ❑ A. Networking Operation, Planning or Management (including Data Communications Management)
- ❑ B. MIS/DP Operations, Planning or Management
- ❑ C. Corporate Management
- ❑ D. Networks/Systems Implementation
- ❑ E. Systems Integration
- ❑ F. Other _____

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- ❑ C. Corporate/Administrative
- ❑ D. Finance/Accounting
- ❑ E. Engineering
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- ❑ L. Education/Training
- ❑ M. Technical Support
- ❑ N. Consulting
- ❑ O. Other _____

6. What is your job title?
- ❑ A. Chairman, President, Owner, Partner, CEO
- ❑ B. Vice President, MIS/DP/Networking/Communications
- ❑ C. Vice President (all other VP's)
- ❑ D. Director, Department Head
- ❑ E. Manager, Supervisor
- ❑ F. Engineer
- ❑ G. Consultant
- ❑ H. Other _____

7a. How many Local Area Networks (LANs) are presently installed within your company/organization?
- ❑ A. More than 20
- ❑ B. 10-20
- ❑ C. Less than 10

7b. How many Local Area Networks (LANs) will be added over the next 12 months? (check only one)
- ❑ A. More than 20
- ❑ B. 10-20
- ❑ C. Less than 10

8. Is your network: (check only one)
- ❑ A. Local (within building/campus)
- ❑ B. Metropolitan
- ❑ C. Regional (several states)
- ❑ D. National
- ❑ E. International
- ❑ F. Other _____

9. Does your company's network include: (check all that apply)
- ❑ A. Local Area Network (PC LANs)
- ❑ B. Minicomputer based LANs
- ❑ C. Mainframe LAN (micro to mainframe, mini to mainframe)
- ❑ D. Wide Area Network (including public data network)
- ❑ E. Public Network (including public data network)
- ❑ F. Bypass Network (private network)
- ❑ G. Other _____

10. Estimate value of network equipment and services:

A. Which you helped specify, recommend or approve in the last 12 months?

B. Which you plan to help specify recommend or approve in the next 12 months?

A	B	
❑	❑	$20 million or over
❑	❑	$10 million to $19.9 Million
❑	❑	$5 million to $9.9 million
❑	❑	$1 million to $4.9 million
❑	❑	$500,00 to $999,999
❑	❑	$250,000 to $499,999
❑	❑	$100,000 to $249,999
❑	❑	$50,000 to $99,999
❑	❑	under $50,000
❑	❑	None of the above

11. Which products and/or services do you help acquire, recommend, specify or buy? (check all that apply)

NETWORKING EQUIPMENT
- ❑ A. Local Area Networks
- ❑ B. Modem (9.6 KBPs and over)
- ❑ C. Modem (under 9.6 KBPs)
- ❑ D. T-1/T-3 Equipment
- ❑ E. PBX/Data PBX (including data switches)
- ❑ F. Bridges/Routers/Gateways
- ❑ G. Packet Switches
- ❑ H. Network Management Systems
- ❑ I. Central Office Switches
- ❑ J. Fiber Optic Equipment
- ❑ K. Multiplexers

SERVICES
- ❑ L. Local Service
- ❑ M. Long Distance Service
- ❑ N. Public Data Network Service
- ❑ O. Dedicated Leased Line
- ❑ P. Centrex
- ❑ Q. Central Office LAN
- ❑ R. Satellite
- ❑ S. Fiber Optic
- ❑ T. Packet Switches
- ❑ U. ISDN Service

SOFTWARE
- ❑ W. Network Operating Systems
- ❑ X. Network Management
- ❑ Y. Communications Software
- ❑ Z. Applications Software
- ❑ 1. Call Accounting
- ❑ 2. Systems Software

COMPUTERS/PERIPHERALS
- ❑ 4. Microcomputers
- ❑ 5. Minicomputers
- ❑ 6. Mainframe
- ❑ 7. Front End Processors
- ❑ 8. Terminals
- ❑ 9. Printers

❑ 10. None of the above

12. What is the estimated annual revenue of your company? (check only one)
- ❑ A. $1 billion and over
- ❑ B. $500 million to $999 million
- ❑ C. $100 million to $499 million
- ❑ D. $50 million to $99 million
- ❑ E. under $50 million

13. How many employees are in your company? (check only one)
- ❑ A. 5,000 employees and over
- ❑ B. 1,000-4,999 employees
- ❑ C. 500-999 employees
- ❑ D. under 500 employees

MLL0000

gram to `sort` for ordering the names. If you run either program as superuser, they'll report files executable even if execute permission isn't enabled because the superuser can (potentially) execute any program.

Listing 2C shows a short pipeline using `xtest` to print all user-executable files in the directories contained in the user's command search path. You could substitute `showex`, although it will run more slowly. The `sed` command replaces the colons in the list by spaces, which will then separate the directory name arguments for the `xtest` command.

Picky, Picky

Question: Our main business application software uses the line printer spooler to print "pick" tickets, which list the items to be "picked" from the warehouse and shipped to meet a customer's order. A pick ticket is printed by creating a temporary file that is queued for printing with `lp` and then erased. It is not possible to change the code in the compiled application program and a dedicated printer is used for the pick tickets. Is there some way to make a disk copy of the data that is printed for reformatting later?

Doug Robinson
Orlando, Fla.

LISTING 3: The LP interface program is run by the LP scheduler to actually print the file. You can easily modify this program if it's a shell script to make a copy of a pick ticket before it is printed.

A. The two command lines shown here (before the label commands to print the file*) are sufficient:*

```
initialization commands
shift 5           # arguments 6+ are files to print
for i
do
    ticnum=`grep "PICK TICKET" $i | awk '{print $4}'`
    cp $i /home/pickticket/$ticnum
    commands to print the file
done
```

B. Contents of a sample pick ticket file title line:

```
PICK TICKET     10/12/90          202
```

Answer: The LP system queues a printing request for a specified printer and then services the request when the printer becomes available. When you run `lp` to print a specified file, a reference to or a copy of the file is stored in the queue. The LP scheduling daemon (`lpsched`) prints the files that have been queued. Because the LP system can manage several different printers (that may have different requirements), the LP scheduler executes a special interface program, which is assigned to a printer when it is installed as part of the LP system.

Most LP interface programs are written in the Bourne shell language; however, any language that provides the appropriate program will do. The shell language is generally used because you can write or modify the interface program quickly. Even though interpreted shell programs run slower than compiled language programs, the slower shell script-based interface program won't really slow down printing because the speed bottleneck is generally the mechanical printing operation itself.

The AT&T UNIX LP interface programs for installed printers are stored in one of two directories—`/usr/spool/lp/interface` for the "old" LP spooling system or `/usr/spool/lp/admins/lp/interfaces` for the "new" LP print service facility available starting with System V Release 3.2. The interface program is easy to identify because it has the same name as the printer's logical (or destination) name. Thus, a printer named `laser`, for instance, has an interface program with file base name `laser`.

An interface program is sent a set of arguments when it is invoked by the

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LP scheduler daemon. The first five arguments identify the request (the same identifier you see displayed on your screen when you invoke `lp` interactively), the account name of the user who queued the request, an optional title for this request (specified by the `-t` option of `lp`), the number of copies to print (argument to the `-n` option), and any custom printing options specified as an argument to `lp`'s `-o` option. The files to print are listed starting with the sixth argument.

To make a copy of a file queued for printing you simply have to add a `cp` command to the appropriate interface script. Because the file being printed is a temporary file, it probably has some meaningless name, so you'll want your copied file to have a different name. Thus, instead of using the name passed to the interface program, you might search for an identifying number in the pick ticket file and use that as the file's name.

For example, let's assume that a pick ticket contains a number after the label PICK TICKET. Because the pick ticket is generated by a software program and should always be in the same format, you can search for the ticket number using a command like `grep "PICK TICKET"` *filename*. Then, use `awk` or `cut` to isolate the pick ticket number and use that as the file base name for the copied ticket. As an example, Listing 3A shows some sample code (added to a hypothetical interface script) that assumes that the pick ticket number is contained in the fourth field of the line. Part B of this listing shows a sample pick ticket title line.

Guidelines: Obviously, this column won't be of much interest unless you send us your questions. Try to make your questions as general interest as possible, and, please, no questions regarding specific hardware or third-party application packages. State the UNIX system version, if applicable, for the question at hand. Send your questions to Ray Swartz, "Answers to UNIX," c/o UNIXWORLD magazine, 444 Castro St., Mountain View, CA 94041. Or send them via e-mail to:

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Ray Swartz is the founder of Berkeley Decision/Systems, which specializes in C and UNIX training. His first book discusses using C for business applications, and his second book teaches shell programming using business-related examples.

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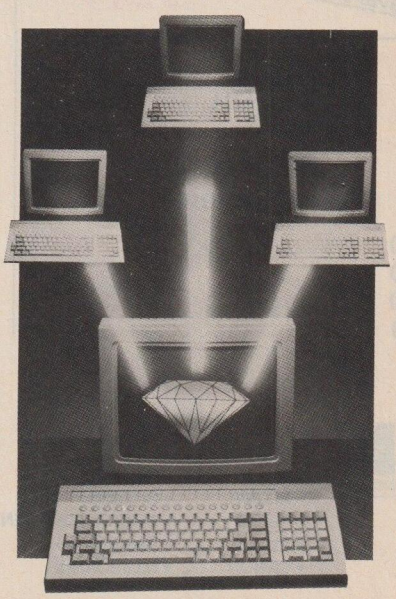

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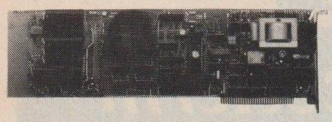

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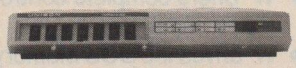

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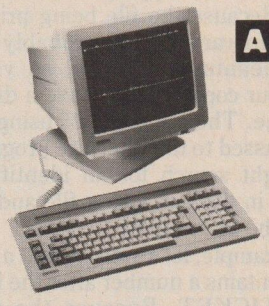

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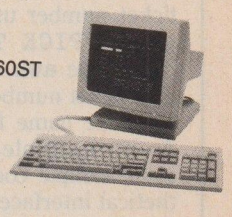

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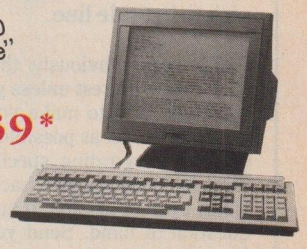

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CIRCLE NO. 202 ON INQUIRY CARD

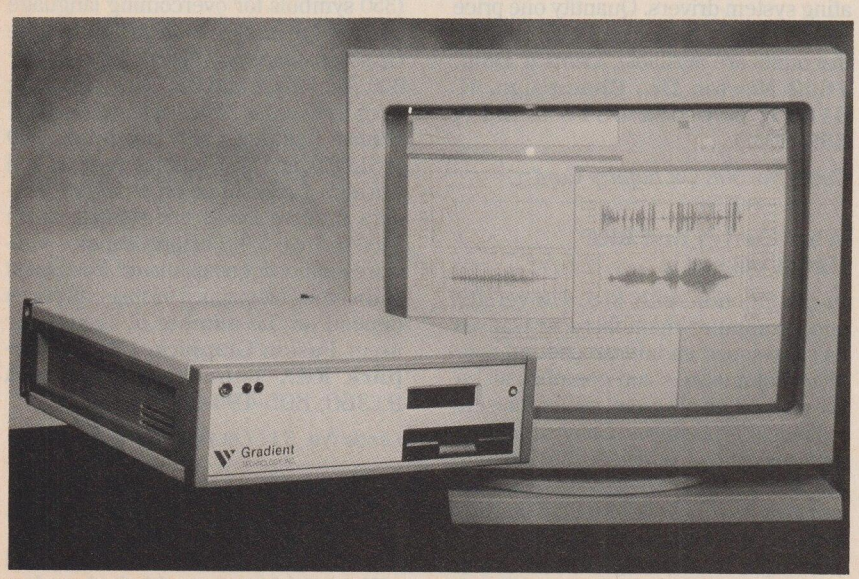
ACQUIRING MINDS WANT TO KNOW ABOUT DATA ACQUISITION

Gradient Technology has developed a SCSI-based data-acquisition device that you can install like an external disk drive without special software drivers. You can use the Desklab peripheral for voice, data, and acoustic sound acquisition and playback, controlling the device from the UNIX command line. You can write programs to call a C function library that comes with Desklab, or you can write applications directly from shell scripts. You can get an optional telephone interface with touch-tone generation and detection, and PBX support.

If you're doing signal analysis, you can use DeskLab's graphics package to zoom, cut, and paste between files; control playback parameters; and compute selected statistics. The graphics package runs under X Windows and SunView. Other data acquisition features allow you to sample data by file size, time elapsed, or even "single utterance." You can integrate floppy or hard SCSI disks to provide standalone operation. There's also an integrated 16-bit bidirectional port for interfacing with existing instrumentation.

Platforms include Data General, Avion, Sun and SPARC, MIPS, and DECstation 3100. Prices start at $5,500. **Gradient Technology, 95B Connecticut Dr., Burlington, NJ 08016; 609-387-8688.**

Circle No. 302 On Inquiry Card



Gradient Technology's Desklab

Some Day My Prints Will Come Over The Network

Applied Computer Sciences' ACScript print server sits between the laser printers and the network to provide a variety of printing services, including the mixture of PostScript and PCL (printer control language) printing in the same document and the merging of on-line forms. It spools print files and stores them on its internal hard disk, and can print in duplex mode (both sides at once).

The ACScript comes in four configurations: The basic unit has a 20-megabyte hard disk, four megabytes of RAM, and three input ports (two parallel and one RS-232); the top of the line unit has an 80-megabyte hard disk, eight megabytes of RAM, and five input ports (four parallel and one RS-232). Each configuration comes with 35 internal, scalable fonts.

The server's "mixed mode" capability allows you to print complex graphics in PostScript and text in PCL, so you can take advantage of PostScript's capability with graphics and PCL's speed with text. Prices range from $2,795 to $4,895. **Applied Computer Sciences, 11711 Northcreek Parkway S., Suite 107, Bothell, WA 98011; 800-525-5512 or 206-486-2722.**

Circle No. 303 On Inquiry Card

Just in XiCASE

Computer Systems Advisers' XiCASE is a CASE tool designed to handle the analysis, design, and prototyping phases of the UNIX-based application development process. XiCASE is separated into modules, each one addressing a different phase of the development life cycle. All of the modules (administration, data flow diagram, entity-relationship diagram, data dictionary, and form) are integrated so that a change made in one module is reflected throughout the project.

The administration module provides the housekeeping necessary in a multi-user, multi-project environment, controlling access to, as well as creation and deletion of applications. The data dictionary module is the central repository of information created by the developers, with links via elements to the diagram modules so the database is always up-to-date. The data flow diagram module supports the Gane and Sarson technique. You can move, remove, and create data flow objects, and develop unlimited levels of exploding and imploding within data flow diagrams.

The entity-relationship diagram module supports the Peter Chen technique, including drawing and documentation of entities and relationships, integration, and decomposition of data models, and generation of relations in third normal form. The form module supports report and screen layouts in normal and condensed modes. Platforms include the AT&T 3B2, the NCR Tower, IBM RS/6000, and Intel i386-based PCs with two megabytes of main memory and at least eight megabytes of storage. Price for the basic two-seat

XiCASE system is $3,995, increasing by two-seat increments up to eight seats per host. **Computer Systems Advisers, 50 Tice Blvd., Woodcliff Lake, NJ 07675; 201-391-6500.**

Circle No. 304 On Inquiry Card

Hewlett-Packard Builds A GUI Builder

HP has jumped into the GUI builder business with the HP Interface Architect, designed for the development and testing of Motif and X Windows-based applications. The software allows programmers to draw the interface on the screen (rather than writing code) by selecting interface components from menus and positioning them on-screen. Components can then be moved, resized, changed, and deleted easily. A built-in C interpreter lets you toggle between creating the interface's behavior and interacting with code that doesn't relate to the interface, so that you can test the interface without dealing with edit, compile, and debugging cycles. After design and testing, the software generates the C code associated with the interface, which can then be ported to other non-HP platforms. Prices for HP Interface Architect licenses start at $5,000 and go up to $60,000, depending on the number of licenses purchased; the media and manual package costs $500. **Hewlett-Packard, 19310 Pruneridge Ave., Cupertino, CA 95014; 800-752-0900.**

Circle No. 305 On Inquiry Card

Waiting For The Commands, Sir

Adding to its series of handy pocket-sized guides, Specialized Systems Consultants has published a command summary for System V Release 4, the merging of System V with BSD features. The reference guide details command syntax, describes options available for each command, and includes a comprehensive summary of the `nawk` command and a five-page summary on the System V shell. Other expanded sections cover `ed`, `sdb`, `sed`, and `telnet`. Cost is $8. **Specialized Systems Consultants, P.O. Box 55549, Seattle, WA 98155; 206-527-3385.**

Circle No. 306 On Inquiry Card

VME Meets X.25

SBE's Vcom-25 high-speed serial interface is a VMEbus-based communications controller in a 9U form factor. Using 20-MHz 68020 processors, the board gives you four or eight full-duplex, independently programmable serial ports that support speeds up to T1 (1.544 megabytes per second); it's also available with X.25 software. With its front-panel connects, you can configure the controller for a variety of serial requirements, including RS-232-C, RS-449, and V.35. The Vcom-25 supports DMA functions for asynchronous, byte-synchronous, or bit-synchronous protocols. You can get one or four megabytes of DRAM, up to four megabytes of EPROM, and an industrial operating range from 0 to 70 degrees Fahrenheit. Price gradations are according to order quantities, from $2,200 to $3,200, based on quantity 100 and quantity one orders, respectively. **SBE, 2400 Bisso Ln., Concord, CA 94520; 800-347-2666 or 415-680-7722.**

Circle No. 307 On Inquiry Card

A Terminal Server For The Sun

If you want to use your SPARCstation as a host for terminals, you can install an S-Bus-based multiport board. Or, if you want to conserve the internal slot, you can install Central Data's SCSI terminal server. Via the SCSI bus, the terminal server provides 16 serial ports. Multiple terminal servers linked together can connect up to 112 ports on a single SCSI bus (leaving no SCSI address for a disk or tape drive). The product also supports SCO UNIX.

Packaging options include standalone, mounting the server inside a system cabinet, or placing it in an unused 5 1/4-inch drive bay, with each version including cabling and appropriate operating system drivers. Quantity one price for the 16-port version is $1,395; quantity discounts are available. **Central Data, 1602 Newton Dr., Champaign, IL 61821; 800-482-0315 or 217-359-8010.**

Circle No. 308 On Inquiry Card

What Convex And Rice Have Cooked Up

In conjunction with Rice University, supercomputer manufacturer Convex has developed an interprocedural compiler that analyzes and compiles an entire application program, rather than just individual procedures. Convex believes the Application Compiler is the first integrated, language-independent compiler, and that it will come into play because the most efficient use of parallel processors requires knowledge of an entire application, not just the procedures.

For both Fortran and C users, the Application Compiler features include automatic in-lining (the removal of call overhead for frequent procedures to improve performance), pointer tracking (which lets C code be highly optimized), as well as constant propagation, procedure cloning, and error checking. Price is $15,000 for either the Fortran or C compiler, or $25,000 for both. **Convex Computer Corp. 3000 Waterview Pkwy., Richardson, TX 75080; 214-497-4000.**

Circle No. 309 On Inquiry Card

Fujitsu Fixes A Flat

Fujitsu's FPF17000S flat-panel 18-inch monitor measures 3 1/2-inches wide and weighs about five pounds, with grayscale resolution of 1024-by-816. While you can use it as a replacement for IBM's discontinued 3290 display terminals, you can also use it in the workstation environment for split-screen and graphics-intensive applications. Color scheme is neon orange-on-black. Sample units cost $4,500. **Fujitsu, 3330 Scott Blvd., Santa Clara, CA 95054; 408-562-1000.**

Circle No. 310 On Inquiry Card

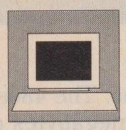
Quick, Henry, The Clip Art

Fusion Graphics has added to its library of clip art packages for UNIX workstation platforms (including HP, Sun, DEC, IBM, MIPS, SGI, and Sony). Packages include DreamMaker Software's Cliptures 3 for Sports (200 sports images; from $130 to $909.65); Innovation Advertising's International Symbols and Icons (350 symbols for overcoming language barriers; from $99 to $693); One Mile Up's Aerospace and Naval clip art (over 240 Air Force and 320 Navy images; from $599 to $4,193); TechPool Studios' Human Anatomy collection (from $229 to $1,603); and 3G Graphics' Accents and Borders (some in color, including borders, framers, labels, and symbols; from $100 to $909.65). Fusion Graphics' software supports encapsulated PostScript and various bit-mapped formats; all prices depend on the number of licenses or users. **Fusion Graphics, 1728 Moorpark Rd., Thousand Oaks, CA 91360; 805-494-8411.**

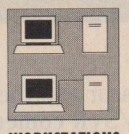
Circle No. 311 On Inquiry Card

Sure, We Can Use Another X Terminal

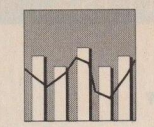
Wyse Technology has joined the flood of X-terminal vendors with the introduc-



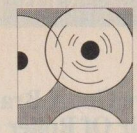
PERSONAL COMPUTERS



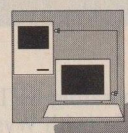
WORKSTATIONS



COMPUTER GRAPHICS



DIGITAL IMAGING/ OPTICAL DISK



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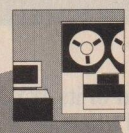

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CIRCLE NO. 22 ON INQUIRY CARD

tion of its WY-X5, incorporating MIT's X.11 Release 4 server code (with Wyse optimizations) and a 32-bit 68020 microprocessor. The WY-X5 has a non-interlaced monochrome 17-inch display, a 70-Hz refresh rate, and 1280-by-1024 pixel resolution. Network connectivity options include thick or thin Ethernet cabling, as well as the TCP/IP protocol. Up to five megabytes of system memory can be installed using SIMMs (single in-line memory modules). Prices start at $1,799. **Wyse Technology, 3471 N. First St., San Jose, CA 95134; 408-473-1200.**

Circle No. 312 On Inquiry Card

I See X Dots Before My Eyes

If you're using an IBM RS/6000 workstation and you need to communicate asynchronously with a remote data terminal, Hugbunadur's HBX-PAD allows you to access the terminal via the CCITT's X.3, X.28, and X.29 protocols (all relating to packet assembly and disassembly techniques). Security features within HBX-PAD let you limit access to specified callers and limit callers to specified functions within the RS/6000. You can transfer files to or from the remote device using common file transfer utility programs. Cost is $2,000 per CPU. **Hugbunadur, P.O. Box 437, 202 Kopavogur, Iceland; 354-1641024 (voice) or 354-146288 (FAX).**

Circle No. 313 On Inquiry Card

DPT Mixes and Matches Disk Controller Upgrades

You can add various hardware and software components onto DPT's new SmartCache Plus line of PC based disk controllers. Available in both AT-bus ($595 for hard disk, $655 for floppy disk) and EISA-bus configurations ($785), you can add (or increase) cache memory and disk mirroring capabilities. The cache memory module with 512K cache RAM on it is $555; adding two megabytes of memory costs $495, while adding four megabytes of memory costs $795. The SmartCache mirroring module for fault-tolerance is $800. The SmartCache line supports SCSI-1 and SCSI-2, and drivers for UNIX and XENIX are available for $80 each. **Distributed Processing Technology, 140 Candace Dr., Maitland, FL 32751; 407-830-5522.**

Circle No. 314 On Inquiry Card

I've Got A Brand New Pair Of Roller Skates, You've Got A Brand New Key

ProTech's Microprocessor Key is a security device designed to be packaged with your software that plugs into the RS-232 port on a UNIX workstation or minicomputer. When installed, the user can run the software–without it, they can't. A microprocessor built into the key can respond in a variety of ways to interrogation from the software, enabling the software's use. Designed to prevent illegal duplication of software, users can still make backup copies.

Other features include the developer's ability to customize communication between the computer and the key, and base the response algorithm on a proprietary ROM table (unique to each developer). To an outside signal monitor, the responses from the key appear to be random signals. Price is $100 for quantity 100. **ProTech Marketing, 9600-J Southern Pine Blvd., Charlotte, NC 28217; 704-523-9500.**

Circle No. 315 On Inquiry Card

Presenting SCSI-2, The Subsystem

MicroNet Technology's new line of SCSI-2 storage subsystems for MCA and EISA computers includes a 32-bit address path, synchronous SCSI-2 transfer, and bus mastering. Available in capacities ranging from 110 megabytes to 2070 megabytes, the subsystems are compatible with previous MicroNet subsystems using the company's 16-bit bus mastering host adapter. The subsystems use SCO UNIX and XENIX native drivers, and have sustained data transfer rates of at least three megabytes per second, according to MicroNet. Prices range from $2080 to $12,185.

MicroNet has also introduced new disk array subsystems using a UNIX device driver that allows multiple hard disks to be spanned, striped, and mirrored for increased speed, capacity, and fault tolerance. Retail prices range from $8,190 for 642 megabytes to $14,9990 for two gigabytes. **MicroNet Technology, 20 Mason, Irvine, CA 92718; 714-837-6033.**

Circle No. 316 On Inquiry Card

My, How These Laptops Grow

Grid Systems, until now solely part of the laptop and desktop computer market, has unveiled a network server incorporating the Intel i486 microprocessor and the EISA bus. The 486ei-25/SVR comes with 8 megabytes of RAM (expandable to 64 megabytes), seven 32-bit expansion slots, and nine expansion bays for up to four gigabytes of storage. Other features include an extended VGA graphics adapter for up to 1024-by-768 resolution, one parallel and two serial ports; and a 1.44-megabyte 3 1/2-inch floppy disk. The basic configuration costs $11,999. **Grid Systems, 47211 Lakeview Blvd., Fremont, CA 94538; 415-656-4700.**

Circle No. 317 On Inquiry Card

The View From The Xiew

Keystone Software Development's Xiew program is designed to manage and interactively manipulate the UNIX file system, and is targeted at developers and system administrators. With it, you can display information about the current directory and file systems, including free space on each file system, a list of directories sorted by the amount of data in each, and the contents of the current directory in several ways. The latter displays include type of file, size, date of last change, ownerships, and permissions.

You can mark a single file, directory, or group of files so that the group can be manipulated with a single keystroke. In this way, a group of files can be copied, moved, or deleted in the same way a single file can. Xiew also allows you to search the file system for any directory or file, or search the contents of the files using regular UNIX expressions. The marking option also lets you send lists of files to system programs for use in creating backups and file distributions. An on-line help screen is also included. The software runs with SCO XENIX and systems support COFF format executable binaries. Priced at $395. **Keystone Software Development, 1800 Avalon Lane, Olathe, KS 66062; 913-829-0157.**

Circle No. 318 On Inquiry Card

A New Way Of Looking At Graphics

Comtrol's MultiVision is a high-speed controller that lets you connect up to 16 users running graphics applications to an Intel 80x86-based PC. There are several pieces to the MultiVision system. First, the Host Controller ($995) fits into a single AT-bus slot and contains four high-speed ports to connect to the MultiVision Cluster ($1,995) via standard twisted-pair or coaxial cable. Each clus-

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CORPORATE NETWORKED COMPUTING

May 20–23, 1991 Georgia World Congress Center Atlanta, GA U.S.A.

CIRCLE NO. 71 ON INQUIRY CARD

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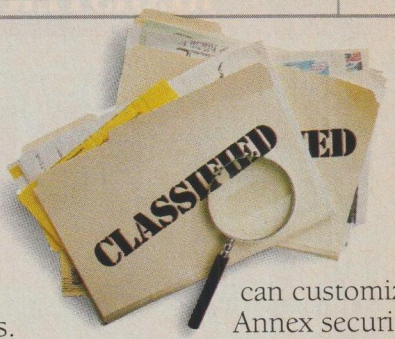

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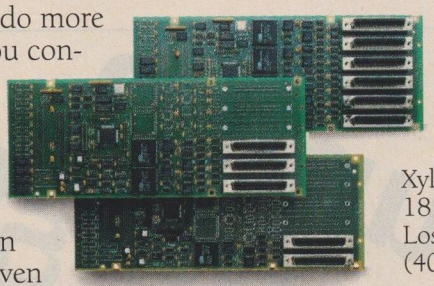

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ter in turn contains four AT bus slots for VGA controllers, four keyboard ports, five serial ports, and one parallel port.

Connecting to the Clusters are the Graphics Station Adapters ($186 each), which contain a VGA monitor port, a keyboard port, a serial port, and 25-foot cables. These connect to the Graphics Stations, which encompass a VGA controller, a monitor, mouse, and keyboard. MultiVision works with SCO UNIX and XENIX, AT&T UNIX, and X Window-based applications. High-speed cables are available in various lengths; for example, a system capable of connecting four graphics stations up to 225 feet from the host costs $3,742. **Comtrol, P.O. Box 64750, St. Paul, MN 55164; 800-926-6876 or 612-631-7654.**

Circle No. 319 On Inquiry Card

Two Can Play At This Game

Over across the river in Minneapolis, Comtrol's neighbor Digiboard has worked up a similar system for graphics connectivity, the MV/4 multivideo graphics adapter. With the Digiboard version, you install an MV/4 card into the PC. On the card is a megabyte of RAM for video memory, and a ROM BIOS to avoid conflicts with other peripheral devices installed on the system. Connected to the board are the adapter boxes, which hold the connects for the monitor, keyboard, and mouse. The adapter boxes can be located up to 200 feet from the host CPU.

Four video chips provide VGA resolution, and four microcontroller chips provide enhanced keyboard and mouse support. The DigiChannel MV/4 works with UNIX, XENIX, and SCO Open Desktop. The MV/4 board costs $1,895, while the adapter boxes cost $417 each. A typical four-user configuration costs $2,759. **DigiBoard, 6751 Oxford St., Minneapolis, MN 55426; 612-922-8055.**

Circle No. 320 On Inquiry Card

A Jukebox For The Desktop

Laser Magnetic Storage's new LF 500 Autochanger Subsystem is a desktop jukebox designed to hold up to 32 removable 653-megabyte optical disk cartridges. Providing unattended access to up to 20 gigabytes of data, the LF 500 can handle either WORM (write-once, read-many) disks, rewritable disks, or both at the same time. The LF 500 comes in four configurations: with one or two WORM drives, and with one or two multifunction drives. Prices range from $15,185 to $17,650, depending on configuration; in OEM quantities, write-once media is $113, and rewritable media is $170. **Laser Magnetic Storage International, 4425 ArrowsWest Dr., Colorado Springs, CO 80907; 719-593-7900.**

Circle No. 321 On Inquiry Card

Stallion Rears Some X.25 Cards

Stallion Technologies OnBoard-Sync is a PC-based subsystem consisting of an internal card (available for AT, EISA, and MCA buses) and an external box with eight asynchronous ports and two

CIRCLE NO. 1 ON INQUIRY CARD

synchronous ports. Using a 16-MHz 80C186 microprocessor and 256 kilobytes of RAM, the OnBoard-Sync system runs a real-time operating system based on AT&T's Streams I/O subsystem so that multiple protocols can be run on the internal card, including X.25 for wide-area networking. Via the subsystem's synchronous channels, you can provide support for TCP/IP and OSI networking protocols.

A Streams-based Protocol Development Kit (PDK) allows developers to use other communications protocols such as SDLC or Bisync which can be developed on the host as Streams models and then downloaded onto the card. For operating systems that don't support Streams (i.e., DOS), the PDK has other tools that allow multi-threaded protocols and real-time applications to be developed. The OnBoard-Sync system is priced at $1,595, and the PDK is $2,395, including the DOS or XENIX development environment, object libraries for downloaded firmware, C source code (including files), and users' guide.

Also available from Stallion is the Xtream-25 coprocessor card, which incorporates the Streams protocol the same way the OnBoard-Sync does, except that it does it internally, taking up two slots in the PC. Priced at $1,095, you can also use the same PDK with it as well. **Stallion Technologies, 983-B University Ave., Suite 104, Los Gatos, CA 95030; 408-395-5775.**

Circle No. 322 On Inquiry Card

More Passengers For The SBus

Sun's own contributions to the deluge of SBus-based peripheral cards are the Serial Parallel Controller card and the SCSI Host Adapter card. Each works with all SBus-based systems, including the SPARCengine 1E board. The Serial Parallel Controller card adds eight serial ports and one parallel port for linking asynchronous devices such as modems, printers, and terminals, and supports up to 38.4 Kbaud for each independently programmable port. Each card comes with a patch panel, a cable, and a floppy diskette containing the loadable device driver and installation guide.

The SCSI Host Adapter is an 8-bit, single-width card that can add up to seven additional SCSI devices to the computer, supporting up to 2.6 gigabytes of disk storage. Prices are $1,095 for the serial parallel controller, and $495 for the host adapter card. **Sun Microsystems, 2550 Garcia Ave., Mountain View, CA 94043; 800-821-4643 or 415-960-1300.**

Circle No. 323 On Inquiry Card

Send In The Clones

CompuAdd's contribution to SPARCmania is the 12.5-MIPS SS1 SPARC workstation, using a CompuAdd-designed motherboard and LSI Logic's 20 MHz SparKit-20 chip set. Because it incorporates the SunOS, an implementation of Berkeley UNIX 4.3, you also get TCP/IP networking, the NFS file system, and SunView windowing. It comes with 8 megabytes of memory, expand-

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SHOWS & CONFERENCES

Windows and OS/2 Conference: March 5-7
This show is targeted for individuals responsible for selecting and evaluating computer products for purchase.

On the roster of Windows and OS/2 Fast Track tutorials to enhance corporate workplace productivity are: Word for Windows templating, desktop publishing with Windows, networking with Windows, automating document searches with SmartText, and installing and configuring Windows. Industry luminaries slated to chair specific sessions include: Amy Wohl, president, Wohl & Associates, "Managing the Migration [of DOS]"; James T. Royston, director, Information Technologies, Imaging Information Systems Group, Eastman Kodak Company, "Thinking GUI"; and Tony Pizi, Merrill Lynch, "End User Development." The conference will be held at the San Jose Convention Center, San Jose, Calif. Contact Sandy Kaczmarczyk, 415-601-5000.

ACM Computer Science Conference: March 5-7
Presented by the Society for Computing and Information Processing, the Computer Science Conference will feature speeches, 10 panel sessions, seven full-day tutorials, 70 technical exhibits, and discussions on the "technology transfer pipeline," from current research and government funding to critical emerging areas and growing international competition. Keynote speakers are H.T. Kung, professor of Computer Science, Carnegie-Mellon University; Phil Hester, director of the Engineering Center for IBM's Advanced Workstation Division; Craig Fields, president, MCC Corp., private-sector research consortium; and John McCarthy, professor of Computer Science, Stanford University.

The seven full-day tutorials, to be held on March 4, are designed to prepare conferees on such topics as RISC architecture, object-oriented databases and programming, parallel and distributed computing, tools for automating software development, supercomputer architecture, and artificial neural networks. The conference will be held at the San Antonio Convention Center, San Antonio, Tex. Contact Don Nowak, 212-869-7440, ext. 223.

Scoop West: March 11-14
Scoop West is an international object-oriented programming event that will feature 40 lectures, workshops, tutorials, technical paper presentations, and exhibits highlighting the newest object-oriented programming-related products and services. The show will be held at the Fairmont Hotel, San Jose, Calif. Contact Bob Daniels, 508-649-9731.

LAN Expo '91: March 13-15
Featuring the latest technologies, products, and applications, LAN (local-area network) Expo is the first show of LANs presented in Japan. Top exhibitors from the industry will demonstrate the fundamentals of LANs and introduce the current trends in LAN technology. The show is designed not only for professionals, but for non-technical persons, as well, who wish to learn the basics of LAN technology and its systems.

Topics to be discussed include: discovering the perspectives and demands of users, analyzing future industry trends and implications, and exchanging views with industry leaders and specialists. Slated for exhibit are LAN hardware and software products, computer-related products (workstations, personal computers), and LAN-related parts and materials. Scheduled attendees are specialists from the fields of LAN architecture and design. The show will be held at Prism Hall (Tokyo Dome), Tokyo, Japan. Contact Marcom International, Inc., +81-3-403-8515.

Hannover Fair CeBIT '91: March 13-20
CeBIT focuses on the integration of data processing and telecommunications through networking, open systems, and new international standards. Scheduled are 4,000 exhibitors from 40 countries, including the U.S.S.R. and Eastern Europe. Among 67 exhibits are two individual Open Systems Interconnection (OSI) exhibits: EurOSInet (European hardware and software vendors) and MultiNet. A special section for American hardware and software developers in the computer graphics, imaging, and multimedia fields will be added. This section will consist of open modules with desktop space instead of the cus-

continued on page 168

UNIXWORLD

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EurOpen
The European Forum
for Open Systems

Distributed Open Systems in Perspective

Spring '91 Conference and Exhibition

20-24 May, 1991
Tromsø, Norway

EurOpen (formerly EUUG) — The European Forum for Open Systems is a non-profit making organisation. It is an international federation of UNIX and Open Systems Users groups.

The EurOpen membership is comprised primarily of institutional and individual members of affiliated National Groups. There are, at present 20 National Groups with a total membership of approx. 5,000 coming from such diverse backgrounds as software engineering, information technology, computer manufacturers, end-users, software houses, universities and research centres. EurOpen runs two major conferences each year on a European level.

The Spring '91 Conference will be held in Tromsø, Norway in conjunction with the Norwegian UNIX systems User Group (NUUG) at the Kulturhuset, Tromsø on 22nd, 23rd and 24th May. Tutorials related to Distributed Open Systems and other topics will be held at the SAS Royal Hotel, Tromsø on 20th and 21st May. The event will be accompanied by an Exhibition.

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Fax: + 44 763 73255

email: europen@ EU.net

CIRCLE NO. 9 ON INQUIRY CARD

able to 64 megabytes on the motherboard. Of its three SBus slots, one is occupied by a video controller. A diskless version with a 19-inch monochrome monitor costs $5,995, with other configurations costing up to $9,695. **CompuAdd, 12303 Technology Blvd., Austin, TX 78727; 512-250-1489.**

Circle No. 324 On Inquiry Card

More PC X Servers

Using AGE's X server, Number Nine has developed a high-resolution graphics board to let PCs running SCO, ISC, and AT&T UNIX double as X workstations. The 9GX X-series supports display resolutions from 640-by-480 to 1280-by-1024, at one to eight bits per pixel. Also included are X Windows drivers optimized for use with the 60 MHz version of TI's 34010 graphics coprocessor.

The 9GX also offers monochrome emulation, so it can act as the primary graphics board, and VGA pass-through so that existing VGA adapters can share a single monitor. An optional 16-bit plug-on VGA module eliminates an additional CPU slot. Price starts at $1,095. **Number Nine, 725 Concord Ave., Cambridge, MA 02138; 617-492-0999.**

Circle No. 326 On Inquiry Card

Getting On The Right Track

Pencom Software has developed No Problem for software engineers to track defects in UNIX software. Designed as a multiuser problem management system, it can be used to log problems found in software during development, test, and support cycles. No Problem tracks each defect throughout its lifecycle, keeping the defect and all related information organized. It includes a menu-driven interface and on-line tutorials.

The software can interface either with a database or with Pencom's own proprietary data management package (included at no charge). It also includes automated management reports that users can use or configure their own. They can also set up the software to notify you by electronic mail based on the occurrence or absence of significant activities related to a problem report. Platforms include SPARCstation, IBM RS/6000, and SCO UNIX. Price starts at $995, based on the number of users. **Pencom Software, 9050 Capital of Texas Hwy.**

North, Suite 300, Austin, TX 78759; 512-343-1111.

Circle No. 327 On Inquiry Card

Three's No Crowd For Optical Storage

Perceptics has developed the TDP-525, a triple-drive pack of its write-once 5 1/4-inch optical storage subsystems, built to fit under UNIX workstations and provide up to two gigabytes of storage. Connecting via the SCSI port, the TDP-525 uses Perceptics' LaserWare software that makes the optical disk drive transparent to the operating system. Price is $17,950. **Perceptics, 725 Pellissippi Pkwy., Knoxville, TN 37933; 615-966-9200.**

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Hardware & Software Support

To **Concurrent 6000** real-time computers: Gensym's G2 real-time expert system development software (617-547-9606).

To **Convex**: Stardent's Application Visualization System (AVS) graphics and imaging software (214-497-4000).

To **Data General's Aviion**: Cognos' PowerHouse 4GL (617-229-6600); Informix's Wingz graphical spreadsheet (415-926-6300).

To **Digital DECstation**: Cadre Technologies' Teamwork/Ada code design management software (401-351-5950).

To **Hewlett-Packard 9000**: Pentamation's information systems software for school districts (215-691-3616); Tetra Systems' Tetrascan image scanning system (415-493-7290).

To **IBM RS/6000**: Facts' Unifacts-X accounting software (011-0234-213233); Franklin Datacom's multiple protocol front-end processor (805-373-8688); Franz's Allegro CL common lisp language (415-548-3600); ICAD's knowledge-based engineering software (617-868-2800); State of the Art's M*A*S 90 Evolution/2 accounting software (714-753-1222).

To **Intel UNIX**: Syntax's LMserver for linking DOS networks and UNIX computers (206-833-2525).

To **Kyocera** laser printers: Lexi Computer Systems' Envelope/Sheet Feeder Model II for second sheets, envelopes, or labels; VOS-3000 Volume Output Stacker for stacking 3000 sheets of paper face down in proper order; and HCF-2700 High Capacity Feeder for holding 2700 sheets of paper (508-681-1118).

To **Mars Mariner 4i** workstation:

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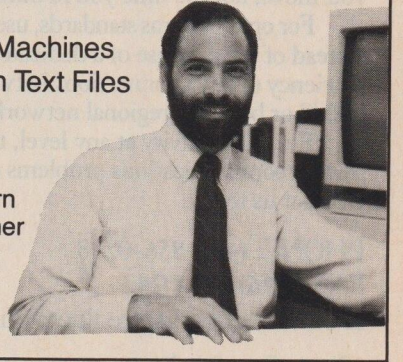

Use it to keep your books. Use it to learn shell programming from an expert. Either way, it's **only $79.95** plus shipping. Ask about our **limited time free offer.**

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Phone: (408) 458-9708 **FAX:** (408) 462-6355

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Xgraph's X window server (408-492-9031).

To **Progress DBMS**: JYACC's JAM application development tools (212-267-7722).

To **Sun Newsprint**: Gammadata's Gammacolor System 300 printer server modules for digital screen capture, HPGL, and color PostScript (312-541-9119; To **Sun Open Windows**: Island Graphics' Island Write, Paint and Draw (415-491-1000); to **Sun SPARCstation**: Aurora Technologies' FD350 (3 1/2") and FD525 (5 1/4") SCSI floppy disk drives (617-577-1288); accounting and business management software from Armor (407-629-0753), Fourgen (206-776-5088), MCBA (818-242-9600), Oracle (415-595-0630), SBT (415-391-9900), and State of the Art (714-753-1222); to **Sun SPARCserver 470 and 490**: Interphase's Omni/400 network coprocessor (214-919-9000); to **Sun 3, 4, and 386i**: Syntax's LMserver for linking DOS networks and UNIX computers (206-833-2525).

To **TeleSoft** Telegen2 Ada compiler: interfaces to Oracle's Pro*Ada precompiler and Sybase's OpenClient and APT-Library (619-457-2700).

To **Unison UPS systems**: Powermon software for unattended shutdown of UNIX-based computers in case of power failure (714-855-8700).

To **Unisys**: NFS support for its CTOS workstations (408-434-2684).

Hardware Upgrades

Cayman Systems restructured the scheduling mechanism in its GatorPrint 1.6 software to improve the speed of its GatorBox AppleTalk-to-Ethernet gateway (617-494-1999).

Cisco Systems adds to its AGS+ FDDI routers the ability to link up to four FDDI networks (415-326-1941).

Para Systems offers Network Manager U/X software for user notification or unattended shutdown of a PC running UNIX or XENIX when power is interrupted (800-238-7272).

Parallax Graphics adds support for live video in Sun OpenWindows and X window environments on its VideoView and Viper videographic processors (408-727-2220).

Software Upgrades

Cadre Technologies adds a Saber-C link to its Teamwork CASE products (401-351-5950).

Dynamic Business Sytems adds a financial report writer and improved windowing capabilities to its Accounting Dynamics module v.4.0; and an inventory cycle tallying feature and improved windowing capabilities to its Distribution Dynamics module v.4.0 (703-549-3738).

Fulcum Technologies adds client-server support to version 5.0 of its Ful/Text information retrieval software (613-238-1761).

Iris Computing Laboratories adds a one-line edit window for shell commands, compilation facilities with forward and backward error-tracking, and improved scrolling performance to version 1.1.5 of its Ie X Window System editor (615-886-3429).

Lynx adds support for real-time Ada,

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threads, and compliance for Posix.1 interface to its LynxOS 2.0 real-time operating system (408-354-7770).

Momentum Software adds multiple-machine functionality to its XIPC version 2.0 interprocess communication software (800-767-1462 or 201-767-1462).

Precision Visuals adds point-and-click capability to its PV-Wave visual data analysis software (303-530-9000).

Sigma Design adds improved DXF translation, floating network license capability, extended VGA options to Arris 5.8 AEC software; support for X Windows; and expanded support for SCO UNIX, DEC Ultrix, and Sun Open Windows (800-356-4568 or 616-771-6745).

Sitka adds support for AppleTalk Phase II support to its SunTops 3.0 Sun-to-Macintosh connectivity software (415-769-9669).

Statware adds cut-and-paste and linking capabilities across multiple windows; new statistical procedures and quality control techniques; and two new modules for programmatic interfaces and custom graphics to its Statit 2.3 data analysis software (503-753-5382).

Tecsys adds automatic product allocation, customer order consolidation, prepaid customer orders, returns approval processing, and bids-and-offers entry matching to release 2.3 of its Informix 4GL-based financial and distribution software (514-333-0000).

Uniplex enhances its integrated office software with Datalinks, a SQL-based interface to link its applications with Informix, Oracle, and Ingres databases (214-717-0068).

Unisys upgrades its CTOS TCP/IP with a UNIX BSD-compatible socket library, and its CTOS VT220 DEC terminal emulator with Kermit and Xmodem protocol support (408-434-2684).

Compilers & Development Kits

To **C++**: Abraxas Software's CodeCheck 2.0 automates the source code review process (503-244-5253); Saber Software's Saber-C++, a dual development environment for C software engineers who want to make the transition to C++ on an incremental basis (617-876-7636).

To **Motorola 68000**: TeleSoft's TeleGen2 real-time integrated Ada development (TRIAD) system incorporating Ada-based development tools and real-time runtime components (619-457-2700).

To **SQL Solutions 4GL**: the SQR Developer's Kit debugging environment that automates the process of tracing errors, scoping variables, and determining program structure (617-270-4150).

Product Line Extensions

To **Concurrent**: the Series 7000 entry-level real-time UNIX computers, based on the 6U VMEbus form factor and the 68040 microprocessor (201-758-7000).

To **EPE Technologies**: an 11 kVA (kilovolt amperes) on-line uninterruptible power system ($24,000), with support for switch-mode power loads and intelligent processing components for easy field replacements (714-557-1636).

To **Intergraph**: a tempest version of its Series 6000 workstations and servers for government applications (205-730-2000).

To **Link Technologies**: the MC6 monochrome graphics terminal with ASCII, ANSI, and PCTerm emulations ($679); the MC70 color terminal with 64 foreground and 64 background colors ($1,295); and the MC230 DEC VT220- and VT320-compatible terminal ($499) (415-651-8000).

To **Princeton Graphic Systems**: color X terminals with X11.4 compatibility, pop-up terminal emulation, and TCP/IP, telnet, Rlogin and SNMP protocols ($1,995 to $5,295); and autosynchronous color monitors in 12-, 14-, and 16-inch sizes ($849 to $1,375) (404-664-1010).

To **Solarix**: a 20 MHz Sun-compatible SPARC-based personal workstation (415-659-1544).

To **U.S. Robotics**: two V.32*bis* modems in internal, external, and rack-mount configurations, designed to recognize when line conditions dictate slower and faster communication speeds (708-982-5010).

To **Versyss**: the Model 600 multiprocessing computer, incorporating three Intel i386 processors, six 16-port I/O boards, two four-port communication boards, two streaming tape drives, four SCSI disk drives, one floppy disk drive, and one externally supported SCSI 9-track tape drive (617-461-6400). ■

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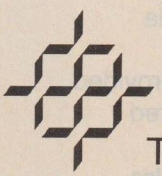

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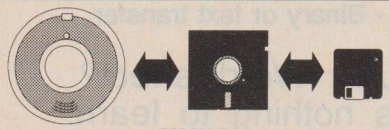

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continued from page 161

tomary exhibit booths. The fair will be held at the Hannover Fairgrounds, Hannover, Germany. Contact Donna Peterson Hyland, Hannover Fairs, U.S.A., Inc., 609-987-1202.

International Conference on Multimedia and CD-ROM: March 18-20
Entitled "Progress and Promises of Multimedia and CD-ROM," the keynote address for this conference will be presented by Bill Gates, chairman, CEO, and co-founder of Microsoft Corp. The conference has traditionally set the stage for the direction of new CD-ROM applications and products. Scheduled are three tracks discussing technology/design, business/marketing distribution, and corporate solutions. Approximately 130 vendors will exhibit. The conference will be held at the San Jose Convention Center, San Jose, Calif. Contact Jon Leibowitz, CD-ROM, 203-352-8224.

DB/EXPO: March 26-28
DB/Expo focuses on distributed databases, tools, connectivity, and interoperability, and is aimed at professionals in the fields of development applications, database administration, and systems analysis and design. This year's theme is "Emerging Technologies for the 90s." On the agenda are multi-track programs discussing: the move toward UNIX, object-oriented and relational database evolution, the impact of standards, CASE tools and repository integration, knowledge-based systems, natural languages, multimedia, distributed processing and interoperability, and downsizing and the microcomputer revolution.

Three days of free tutorials–"UNIX Day," "Mainframe Day," and "Tools and Connectivity Day"–will offer attendees technical support for specific market segments. At least 14 user groups, along with 400 exhibitors and more than 80 speakers, are slated to attend. The exposition and conference will be held at the Moscone Convention Center, San Francisco, Calif. Contact Norm De Nardi Enterprises, 800-2DB-EXPO or 415-941-8440. ■

NEXT MONTH IN UNIXWORLD

Can UNIX Be Presentable?

DOS and Macintosh systems can create impressive business graphics, but somehow the software hasn't made it to UNIX. Worse yet, no leading vendor has a UNIX version on the way. Find out why in our April issue.

The Cobol Connection

As MIS people move to open systems, having Cobol on UNIX is imperative. We dig into using Cobol as the link between UNIX systems and mainframes.

Board with Your Graphics?

Then these products should speed up your picture. Graphics controller boards help off-load your CPU. We'll look at the factors you should consider when adding punch to your system.

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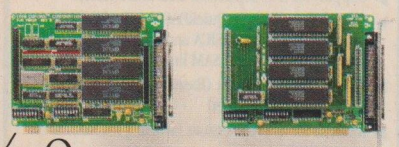
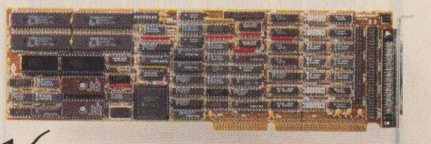


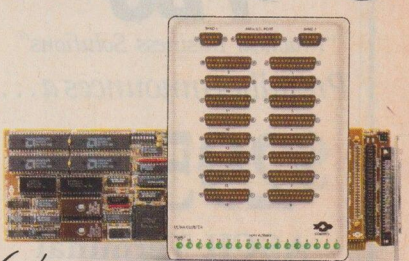
4-8

Our Hostess multiuser serial controllers are an excellent choice for up to eight occasional users. The Hostess 550 provides buffering for even higher performance. And for truly high performance, choose the Ultra 8.



16

Expand up to 16 users with the Ultra 16 high performance intelligent serial controller. But if your multiuser requirements are more modest a 16 port Hostess 550 controller makes an equally intelligent choice.



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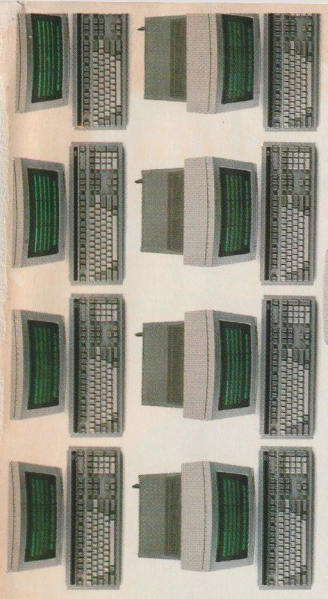

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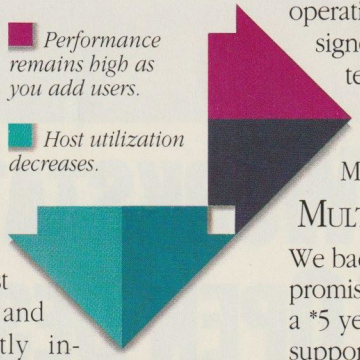

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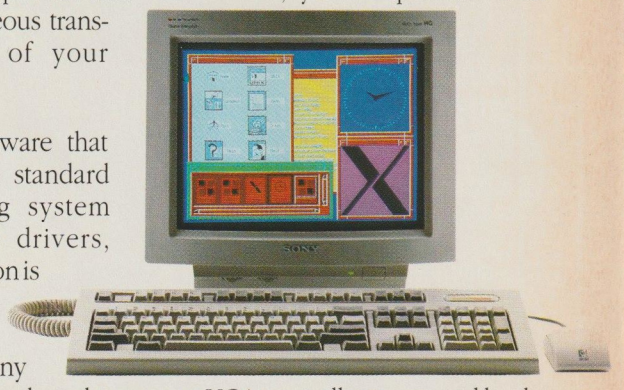

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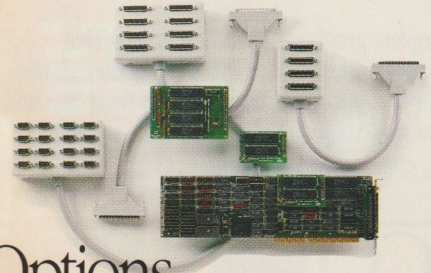

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